W.M. Mann

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PSYCHE

VOL. XLVI JUNE-SEPTEMBER, 1939 Nos. 2-3

NOTES ON BUTTERFLIES FROM HISPANIOLA

By Marston Bates

Museum of Comparative Zoology, Cambridge, Mass.

The island of Hispaniola, broken into many life zones and habitats by its lofty mountain ranges, presents the most interesting—and least known—fauna of any island in the West Indies. Sharpe (1898) and Hall (1925) have given lists of butterflies from the island, the latter enumerating 139 species. The Hispaniolan butterfly fauna is surely as large as that of Cuba and perhaps larger (159 species are now known from Cuba: Bates, 1935; 1936) and almost any collection from the island includes species not previously known from there. The Museum of Comparative Zoology and the American Museum of Natural History now have fairly extensive collections from Hispaniola, and a worthwhile study of the butterfly fauna could be made on the basis of this material. Since, however, there is little likelihood that any such study will be made in the near future, it seems best to publish the following notes on certain particularly interesting species.

The best account of the zoogeography of the island seems to be that of Wetmore and Swales (1931) and most of the localities mentioned in the present paper can be found on their map.

The nomenclature and sequence used in the present paper conforms with that of my "Butterflies of Cuba" (Bates, 1935).

Eurema dina (Poey)

There seem to be two species of *Eurema* in Hispaniola belonging to the *dina* complex: one related to the Cuban *dina* and the other to the Bahaman *helios*. Klots, in his revision of the genus Eurema (1929, p. 139) has considered that *dina* presents a peculiarly complicated taxonomic problem; but this may be due to the frequency with which morphologically distinct local populations are encountered. Individuals from a given population seem to have a quite uniform facies, as is shown by the long series in the M. C. Z. from Cuba *(dina)*, New Providence *(helios)* and Honduras *(westwoodi)*. There is considerable variation in the genital structures as Klots (1928, p. 66) has pointed out; but this variation seems in part at least to be geographical.

The Bahaman populations that I have called "*Eurema chamberlaini* Butler" (Bates, 1934, p. 134) seem to belong to the *dina* complex, and the Cuban *Eurema laræ* (Bates, 1936, p. 226) may also belong there, although as our only specimen lacks the abdomen it is impossible to place it with any certainty. The Puerto Rican *Eurema sanjuanensis* (Watson, 1938) is unknown to me.

The known West Indian *dina* populations might, then, be arranged as follows:

Eurema dina dina (Poey) Cuba
    dina memulus (Butler) Hispaniola
    dina parvumbra (Kaye) Jamaica
    laræ (Herrich-Schäffer) Cuba
    helios helios Bates New Providence, Andros
    helios mayobanex subsp. nov. Hispaniola
    chamberlaini chamberlaini (Butler) Great Inagua
    chamberlaini mariguanæ Bates Mariguana
    chamberlaini subsp. indescr. Cat Is.

Eurema dina memulus (Butler)

Terias memulus Butler, 1871, p. 251, pl. 19, f. 6.

♂. Wings above light orange, somewhat deeper in color toward the margins; apex of forewing black, the inner edge of this black patch evenly rounded or slightly dentate, extending from a point about two thirds of the way out on the costa to the inner angle. Under side yellow: immaculate or with scattered brownish spots on the hindwing. Length of forewing, 16–17 mm.

2♂♂ in the M. C. Z. from Haiti: Ennery (2500 ft., Aug., Bates) and "San Domingo" (Weeks Coll.).

This differs from the Cuban form *(E. dina dina)* in the complete absence of a black border on the hindwing, and in the greater extent of the apical black patch of the forewing. Our specimens agree very well with Butler's description and figure.

Eurema helios mayobanex subsp. nov.

♂. Wings above uniform orange, with a fine black border on the hindwing and a conspicuous border on the forewing, about the same as in the Cuban *dina*. Under side immaculate orange except for a minute double cell spot on the hindwing.

♀. Deeper orange toward the edge of the wings; no black margin to hindwing; apical border of forewing brown rather than black. Under side with a reddish patch at apex of forewing, and another on the margin of hindwing between veins Rs and M_1; some scattered purplish spots on disc of hindwing. Length of forewing, 20–22 mm.

Type (♂) and paratypes (2♂♂, 1♀) from Haiti: Ennery (2500 ft., Aug., Bates).

This form may be distinguished from *dina (s. s.)*, *parvumbra* or *memulus* by the dark orange ground color of both sexes, and from *helios* by the comparatively broad apical border of the forewing.

The "distal process" of the male genitalia of *mayobanex* (Klots, 1928 for terminology) is about twice as wide as in *memulus*, and the various lobes are much more strongly developed in the former species. The genitalia of two specimens of *mayobanex* and of one of *memulus* were examined.

The four specimens of *mayobanex* and the Ennery specimen of *memulus* were all caught on the same day, as were specimens of *Eurema lisa* and *E. proterpia*.

Kricogonia castalia (Fabricius)

In the M. C. Z. there are 21 ♂♂, 7 ♀♀ from: Haiti: Cabaret (Aug.); Mont Rouis (Aug.); Mt. Bourette, La Selle Range (5000 ft., Sept.); Cap Haitien; Rep. Dom.: Bonao (Aug.); Saona Is. (Jan.).

The pattern variation of this species seems to show no geographical correlation, except insofar as certain populations seem to be more uniform than others (*e.g.*, the Bahamas). Very dissimilar specimens from the same region show identical structure in the male genitalia, but there seems to be some, though slight, geographically correlated variation in these organs. The genitalia of the Cuban *K. cabrerai* have not been examined, but the form seems to be distinct. With this exception it seems to me that, pending adequate material from all regions for comparative study, the best course is to treat the entire complex under the oldest name *(Papilio castalia* Fabricius, 1793, Entom. Syst., 3, 1, p. 188, presumably from Jamaica), and to describe the variation shown by different populations in terms as general as possible.

In the Hispaniolan series there are two types of males:

A, with the wings immaculate whitish above, except for the orange area at the base of the forewing, and a light longitudinal streak on the under side of the hindwing;

B, similar above except for a black postmedian bar on the costa of the hindwing, but with the underside of the hindwing uniform light yellow except for a shadow of the black bar of the upper side.

These two types show no intergrades; three specimens belong to type A, the remaining eighteen to type B. We have specimens like type A from Arizona, Nicaragua and Jamaica; like type B from Arizona. These might be considered as "incipient species" but the genitalia of A and B from Hispaniola seem to be identical and slightly different from the genitalia of A and B from Arizona!

Three types of females occur on Hispaniola:

C, above entirely lemon yellow, slightly darker at the base of the forewing; similar below, but with a prominent light longitudinal streak (really a fold) on the hindwing, and a faint silvery reticulation on this wing (1 specimen, Saona Is.);

D, chalky white above, darker on the base of the forewing; similar below, but bright yellow on the base of the forewing, the ground color of the hindwing and the apex of the forewing slightly yellowish, the fold of the hindwing prominent but not marked with contrasting scales (5 specimens);

E, similar but with an indication of a postmedian row of dark spots on the underside of the hindwing (1 specimen, Cabaret).

We have specimens of type C from Texas, Honduras and Nicaragua (the last somewhat intermediate between C and D); of type D from Texas; of type E from Texas. A sixth type with the apex of the forewing rather broadly marked with brown, and with the hindwing somewhat darker than the forewing above, occurs in Guatemala, Honduras and Arizona.

Dismorphia spio (Godart)

Pieris spio Godart, 1819, p. 167 (Antilles).

In the M. C. Z. there are 10 ♂♂, 9 ♀♀ from Haiti: Cap Haitien; La Hotte Peninsula, Camp Perrin, 1000 ft., Oct.; Etang Lachaux, Oct.; Rep. Dom.: San José de las Matas, 1000-2000 ft., June.

The variation in this series is very interesting. The two males from the La Hotte peninsula (Camp Perrin) may represent a distinct population, as they are smaller than any of the other specimens and have the yellow area of the costal margin of the upper side of the hindwing broadly connected with the orange postdiscal area, instead of separated by a black bar as in specimens from Cap Haitien. One yellow male from San José de las Matas, however, has the black bar only partially developed.

Both sexes of this species seem to be dimorphic: of the males in the series, six have orange markings and four have yellow markings; of the females, three are orange and six are yellow. Avinoff (1926, p. 363, pl. 33, f. 1) has described a yellow form from Puerto Rico as "ab. *virago*". The yellow females are strikingly similar to the normal females of the Cuban *Dismorphia cubana*.

Genus **Calisto** Hübner

In my review of the genus *Calisto* (Bates, 1935) I described five new species from Hispaniola, bringing the total known from the island up to nine. This seemed like a very large number of species, and I was greatly surprised to find two more very distinct new species in material collected by Dr. P. J. Darlington in the Dominican Republic in 1938.

One of these is the largest and most striking species of *Calisto* yet to be described. When the island is thoroughly explored, it will probably be found that the various mountain ranges are inhabited by distinct local populations of many of these *Calisto* species, and there is evidence of such geographical variation in some of the series in the collection of the M. C. Z.; there seems, however, to be no point in giving names to such subspecific populations at the present time.

Calisto arcas sp. nov.

♂ ♀. Sexes similar. Upper side: forewing: dark fuscous with a row of large more or less confluent submarginal fulvous spots extending from the inner margin to vein M_2; hindwing with the basal half fuscous, the distal half fulvous, except for a narrow, sharply defined, burnt orange submarginal line and a fuscous margin at the outer angle extending to vein M_2. Under side: forewing: dark reddish brown from base to just beyond cell, except for a black area along the inner margin; postmedian area fulvous, marked off by narrow brown lines; margin somewhat darker; ocellus in the fulvous area: black surrounded by a yellow ring; two bluish white central dots. Hindwing a rich brown, the basal half slightly yellowish, the distal half reddish; distinct antemedian, postmedian and submarginal dark lines; two ocelli of about equal size, both marked with yellow rings, the center black enclosing small, central, bluish-white dots; one ocellus in the M_1—M_2 area, the other in the Cu_1—Cu_2 area; an isolated white dot in the M_2—M_3 area; Length of forewing, 24—27mm.

♂. The androconia are limited to the Cu_1–Cu_2 and Cu_2–2A areas; they do not form a sharply defined patch. The genitalia of this species are quite distinctive: the uncus being asymmetrical, and the valves elongate, squared at the end.

Type (♂) and 3 ♂ ♂ 2 ♀ ♀ paratypes from Valle Nuevo, S. E. Constanza, Rep. Dom., Aug. 1938, c. 7000 ft., P. J. Darlington; 3 ♂ ♂ and 3 ♀ ♀ from Loma Vieja, S. Constanza, Aug. 1938, c. 6000 ft., P. J. Darlington.

The position of vein R_1 of the forewing, which arises at the end of the cell, and the symmetrical ocelli of the hindwing, indicate that this species should be put in the Archebates Group. It differs strikingly, however, from the other members of this group and from all other species of the genus both in genital structure and in pattern. It is the only known species with fulvous markings on the upper side of the forewing, and the only species, except the new one described below as *grannus*, with two symmetrical ocelli on the under side of the hindwing.

Calisto chrysaoros Bates

Dr. Darlington captured four specimens of this species in the "foothills of the Cordillera Central S. of Santiago" and one "between Constanza and Valle Nuevo, 6000 ft." in the Dominican Republic. These differ from the typical specimens from the La Hotte and La Selle mountains of Haiti in having the under side of the hindwing fuscous rather than brown, and in having the white median band of this wing somewhat nearer the similar band over the ocellus. This species, then, seems to occur at high elevations in several parts of the island.

Calisto grannus sp. nov.

Upper side: dark fuscous, the disc of the forewing (androconia patch) very dark. Under side: forewing: fuscous, with a fine dark postmedian line extending from the costal to the inner margin, and with two wavy submarginal lines along the outer margin; ocellus of the usual design: black, ringed with yellow, with two minute white pupils. Hindwing: fuscous, with fine reddish-brown antemedian and postmedian lines and with two very irregular submarginal lines; two symmetrical ocelli (black ringed with yellow or orange, with a single central white dot): one, slightly smaller, in the M_1–M_2 area, the other in the Cu_1–Cu_2 area; a prominent white spot in the M_2–M_3 area and another in the M_3–Cu_1 area. Length of forewing, 16–18 mm.

♂. Androconia patch like that of *C. hysius*. Genitalia strikingly similar to those of *C. hysius*, differing only in details of proportion and chitinization.

Type (♂) and one paratype ♂ from Valle Nuevo, S. E. Constanza, Rep. Dom., Aug. 1938, c. 7000 ft., P. J. Darlington; 3 paratypes ♂ ♂ from Loma Rucilla, June 1938, 8000 ft., P. J. Darlington.

The three specimens from Loma Rucilla differ from the others in that the lines of the under side are more obscure, the ocellus of the forewing smaller.

This species, structurally, seems to be close to *C. hysius*, but it differs from all other species of the *hysius* group in having two symmetrical ocelli on the under side of the hindwing—instead of one asymmetrical ocellus—and in the absence of a distinct red patch in the cell of the forewing.

Calisto pulchella Lathy

Dr. Darlington caught four males of this species in the Constanza region (3000–4000 ft.) which differ rather strikingly from the common Haitian form in having the under side of the hindwing marked with orange rather than reddish-orange, and in having the antemedian and postmedian lines more widely separated.

Hypolimnas misippus (Linnaeus)

There is one male in the M. C. Z. collection from Haiti: Cul-de-Sac Plain, Jan., A. Audant. This is the first record of the species from Hispaniola.

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NOTES AND DESCRIPTIONS OF ORIENTAL ŒSTROPSYCHINÆ (TRICHOPTERA)

By Nathan Banks

Museum of Comparative Zoology

There are a number of species in this group in the Orient, although for many years it was the custom to call every specimen of Polymorphanisus, *P. nigricornis*, and every Œstropsyche as *Œ. vitrina.*

Having a considerable number of specimens from India, it is seen that each is fairly constant in structural characters, both of body and wings.

Polymorphanisus

The species of this genus fall into two sections; one with the fourth fork sharply acute at base and extending well back on the median cell and with the fore wing not especially broad; to this belongs *nigricornis* and some allied forms; the other section has broad, rather short wings, and the fork four is broad at base and goes back but little, if at all, on the median cell; to this group belong *indicus, ocularis, astictus.* The females of the first group from Asia known to me can be separated as follows:

1. Head swollen in front in a rounded lobe, mesoscutellum with two black stripes, discal cell very short *tumidus*
   Head not prominently swollen in front 2
2. Fringe of mid tarsi blackish, antennæ black 3
   Fringe of mid tarsi paler 4
3. A dark spot on mesoscutellum, discal cell short, front legs pale .... *unipunctus*
   No spot on mesoscutellum, discal cell about one half as long as median cell, front tibiæ and often femora blackish .... *nigricornis*

4. Legs yellowish, fringe of mid tarsi yellowish; antennæ dark only at joints; front tibiæ with only a dark dot at tips .... *flavipes*
   Legs pale, not distinctly yellowish, fringe of mid legs silvery, outer half of front tibiæ black; fore wings rather broader than usual .... *hainanensis*

P. taonicus Navas from South China I do not know.

Polymorphanisus nigricornis Walk.

Walker says the antennæ and the fringe on legs black. This form has the front tibiæ more or less dark, and often the femora also. The discal cell is about one-half as long as the median cell, fork one longer than its pedicel, fork four well back on median cell, but not halfway to the cross-vein, latter before middle of cell, cross-vein from median fork to cubitus is straight and about twice its length before base of median cell. There are no distinct marks on the mesonotum, nor does Walker mention any.

Many specimens from Shimoga, Mysore, India.

Polymorphanisus unipunctus Bks. Fig. 4

From Suifu (Graham) and Chin Chi Shan (Gaines Liu), both Szechuan; fork one is very short as well as the discal cell.

Polymorphanisus flavipes sp. nov.

Pale greenish, rarely a trace of dark each side on the mesonotum, abdomen dark, ventral segments more or less tipped with pale; antennæ pale, sometimes somewhat darkened toward tips, the joints narrowly black at tips, basal joint behind with a black streak; legs yellowish, front and mid tibiæ with dark dot at tips, fringe of mid legs plainly yellowish.

Wings greenish, with green veins; discal cell rather short, not one-half of median cell; fork one longer than pedicel, fork four back on median cell about width of median, not halfway to the cross-vein which is much before the middle of cell; cross-vein from median fork to cubitus about two and one-half times its length before median cell; venation of hind wings much as in *nigricornis*.

Length of fore wing 20 to 23 mm.

From Shimoga, and Bhadravati, Mysore, India, in May, June, August, September, and October (Susai Nathan). Two specimens with rather more yellowish wings have a very distinct black spot each side on the mesonotum, and the fourth apical cell is more narrow than in the other specimens. Type M. C. Z. no. 23467.

Polymorphanisus tumidus sp. nov. Figs. 11, 12

Pale greenish, abdomen dull black, mesoscutellum with two short black stripes, antennæ greenish, black mark at the joinings, legs pale greenish, front pair unmarked, mid legs with the tibiæ and tarsi yellowish, a black spot at tips of tibiæ and tarsal joints, the fringe brownish yellow; front of head with a great, smooth, rounded swelling in front.

Fore wings greenish, veins green; discal cell very small, only about one-fourth as long as median cell, and fully as high as long; fork one about three times as long as the pedicel, fork four well back on median cell, but not halfway to the cross-vein, which is much before the middle of cell; cross-vein from median fork to cubitus fully three times its length before median cell; venation of hind wing much as usual.

Length of fore wing 19 to 20 mm.

From Shimoga, Mysore, India, 15 to 28 April (Susai Nathan coll.). Remarkable for the peculiar head. Type M. C. Z. no. 23468.

From the larger Malayan islands there are at least three species, and doubtless more.

Polymorphanisus semperi Brauer

In some specimens there are two faint dark marks on the mesoscutellum, and also present more plainly in all three males I have seen. All of my specimens are from Luzon.

Polymorphanisus fuscus Ulmer

Two females from Telang, Borneo (Grabowsky) have the black spots near base of fore wings; the mesoscutellum is almost wholly black, and two narrowly separated black spots in front on the margin of the mesonotum.

Polymorphanisus scutellatus sp. nov. Fig. 9

Pale yellowish to greenish; no marks on head nor legs; antennæ pale, narrowly dark at tips of joints; mesoscutellum with two black spots; abdomen dull black. Wings greenish, veins green, the veins about discal cell and several apical veins in upper part are bordered with yellowish, much as in *P. semperi.*

Fore wings moderately slender, about as *nigricornis,* not at all sinuate on outer margin; discal cell is four-sided, fork two rather deeply indenting the anastomosis, the discal cell not nearly one-half as long as the median cell, cross-vein from lower side of discal to the median is obliquely backward; median cell very long, not nearly as wide as discal, fork four extending back on the median cell about one-half the width of cell; cross-vein from median cell to cubitus before middle of cell; fork one not nearly as long as its pedicel.

Venation of hind wing much as in *semperi,* except that fork five is only one half as long, shorter than in any other species noted.

Length of fore wing 15 to 18 mm.

From Baram River district, Sarawak, Borneo (H. W. Smith 1912); others marked Sarawak, and one from Hagen collection, Duson Tinoc, Borneo (Grabowsky). Type M.C.Z. no. 23472.

Differs from *semperi* by shape of fore wing and many points of venation.

A specimen from Buitenzorg, Java (T. Barbour) and one from Medan, Sumatra (G. Fairchild) have the same venation but the mesoscutellum is almost wholly black, and quite possibly represent another species.

Œstropsyche vitrina Hagen Figs. 5, 14

Both of Hagen's males have the median cell longer than figured by Ulmer (Selys Monog. Trich. (2) fig. 21) for his Celebes or Sumatra specimen. Fork four is also more geniculate at base than he figures; in the hind wing the venation is much as he figures but forks two and three are well separated at base.

Œ. palingenia Brauer from the Philippines is distinct, and probably also some other island forms. In the female of *palingenia,* the discal cell is not so wide as in the male, and is nearly as far from the radius as its own width, and fork two is not short-pedicellate, but only much narrowed at base. I figure (Fig. 2,) the appendages of a male from Mt. Makeling, Luzon (U.S.N.M. coll.).

I have from India another species, possibly the one referred to *vitrina* by Martynov (Rec. Ind. Mus. XXXVII, p. 93). I give a figure of the fore wing of the type of *Œ. vitrina.*

Œstropsyche hageni sp. nov. Fig. 6

This has the same general appearance as Hagen's species, but is smaller; fore wing 12 mm., Hagen's type 15 mm. The median cell is about a fourth shorter than *vitrina,* with a very short margin on the cubitus, the inner side less sinuate, the fork four fully as much curved at base. In the hind wing fork one is very short, otherwise like *vitrina.* In the mid legs the second tarsal joint is nearly one-half of the first, in *vitrina* scarcely more than one-third, and the membranous margin is of a more even width.

The genitalia have the claspers of about the same proportions as in *vitrina,* but the tip of the penis in *vitrina* has a projection below, which is lacking in *hageni;* from above the superior plate is slightly projecting in the middle.

From Shimoga, Mysore, India, 21 July (Susai Nathan). Type M.C.Z. no. 23469.

Amphipsyche apicalis sp. nov. Figs. 1, 3, 8, 15

♂ Pale yellowish, face silvery on the sides, thorax and apical part of the abdomen rather darker yellow; legs pale whitish, unmarked; antennæ pale, joints narrowly dark at tips; palpi long, apical part rather dark.

Fore wing sparsely clothed with yellowish hair, more yellowish along anal margin, a brighter yellowish cloud before anastomosis, another one transversely beyond anastomosis, and the apical part broadly yellow, in the apical part of fork one is a rounded black spot; hind wings pale whitish. Fore wings rather long, tip broadly rounded. Venation much as in *A. nirvana* (*indica*), the radius strongly sinuate, radial sector nearly straight, median cell more slender than usual, a minute cell at base of fork two which is pedicellate; hind wings much as in other species, the cubital fork slender, as in *A. tricalcarata.* Spurs 1, 4, 4, the subapical pair of hind legs rather small and close together, but plainly two. Male genitalia above much as in *A. distincta,* but from beneath the claspers have the basal part very slender, not at all enlarged as in *distincta;* the penis has a large hump beyond middle, further from the tip than in *A. nirvana,* and the tip of penis, seen from below (or above) is slender and bifid.

Fore wings 13 mm. long.

From Shimoga, Mysore, India, 10 April (Susai Nathan). Type M.C.Z. no. 22677.

Two females from Coimbatore, have fork two pedicellate, but no cell at base, a small dark cloud near upper end of anastomosis, hind tibia with but one preapical spur, may be the female of this species.

Amphipsyche distincta Mart.

A species agreeing in genitalia, head and thorax markings and in venation is common in Mysore, India. Martynov does not mention the front femora which in these specimens are plainly blackish, and show very prominently from in front. The wings of fresh specimens are very plainly greenish. The female also has these black front femora, is smaller, the wings scarcely at all green, but the abdomen is green (at least when fresh). The mesonotum usually has a dark stripe each side, and scutellum largely dark; the brown on head as in male. The mid tibia are broadened as usual, there is a distinct, but sometimes minute, subbasal spur, and the apical spurs are simple, but inner much shorter than outer; hind legs with only the apical spurs. The venation is similar to that of the male, except that the radius, of course, is but little curved near tip, and the cross-vein from median cell to lower median vein is usually much nearer to the middle of cell, radial sector straight. The fore wing is but 6.5 mm. long, male 9 mm. Many from Shimoga, Mysore (Susai Nathan).

Amphipsyche magna sp. nov. Figs. 13, 16, 17

Head and thorax pale yellowish, with more pale hair than usual; abdomen brown; antennæ pale, tips of joints dark; mesonotum with a brown stripe on each side toward wing-base, and a spot each side on the posterior part of mesoscutellum; metanotum with a brown spot each side in front; legs pale yellowish, unmarked; fore wings pale yellowish with yellowish veins (green alive?), the subcosta and radius faintly bordered with yellowish; hind wings very pale.

In fore wings the venation is typical; about seven faint costal cross-veins; the subcosta before tip bends down and then up, and the radius close by follows it, beyond which the radius makes a deep bend; fork one about equal to its pedicel; the median cell broad and rather short, upper side in an even curve.

Legs slender, femora fringed, spurs 1, 4, 2, one of the subbasal pair of mid leg is curved. From above the genitalia show a broad, deeply divided superior plate, the long arms slightly divergent, and almost swollen before tip; the claspers are long and very slender, the apical part straight, tapering, and hardly one-half of the basal part; the tip of the penis from behind appears round, the two dark, pointed processes standing upright, some distance apart.

Fore wing 19 mm. long.

One from Del Carmen, Philippine Islands (Uichanco), 15 Nov. Type M.C.Z. no. 23471.

Amphipsyche delicata sp. nov. Figs. 7, 10

A small, pale yellowish gray species with unmarked wings. Head pale yellowish; antennæ pale, faintly, narrowly annulate with dark; palpi pale, fully as long as usual; legs pale, front tibia with a minute dark spot at tip; fore wings pale yellowish gray, unmarked, the stigmal area rather more yellowish than elsewhere. Venation much as usual, but the median cell extends much beyond the anastomosis, rather more so than in *A. minima*, the median cell is not so much widened in the middle as in *A. minima*, and its upper border is plainly thickened; fork one is scarcely longer than pedicel; one costal cross-vein fairly distinct and sometimes a second shows, fork two sessile.

Mid leg of female with tibia less swollen than in most of the larger species; spurs 0, 4, 4, the preapical pair of hind legs very small, and one of the apical pair is much longer than the other.

Length of fore wing 7 to 7.5 mm.

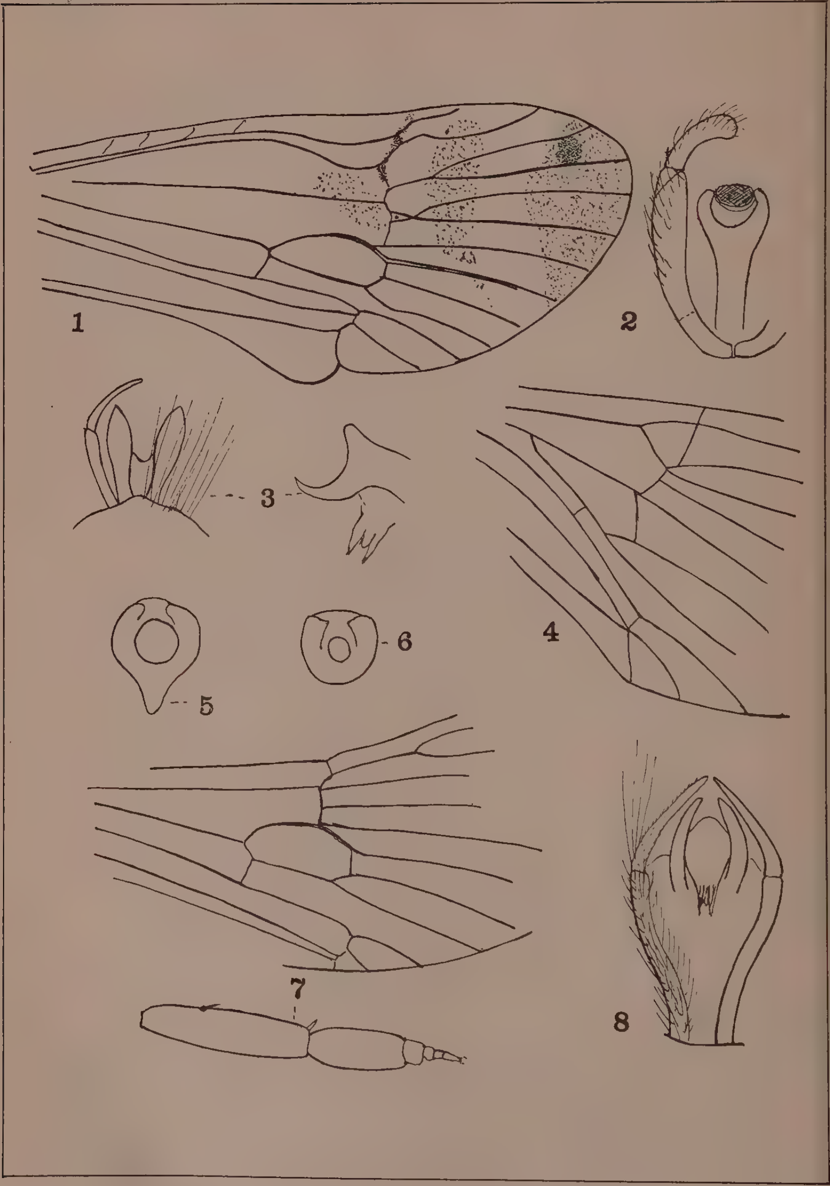
From Chung Kon, 18 July; Dome Mt. 13 July, both on Hainan Island, and Kit Tau, South Kiangsi, China, 20 June (Gressitt). Type M.C.Z. no. 23470.

It differs from *A. minima* in not having fork two pedicellate, in lacking the faint brown band over anastomosis, and in shape of the median cell; from the equally small *A. distincta* it differs in not having front femora and tibiæ darkened, in shape of the median cell, etc.

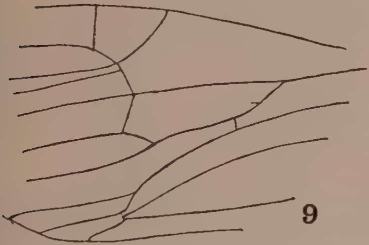
EXPLANATION OF PLATES I AND II.

Fig. 1. *Amphipsyche apicalis*, fore wing.
2. *Œstropsyche palingenia*, genitalia below.
3. *Amphipsyche apicalis*, genitalia above, and penis from side and above.
4. *Polymorphanisus unipunctus*, part of fore wing.
5. *Œstropsyche vitrina*, tip of penis.
6. *Œstropsyche hageni*, tip of penis.
7. *Amphipsyche delicata*, part of fore wing and hind leg.
8. *Amphipsyche apicalis*, genitalia below.
9. *Polymorphanisus scutellatus*, part of fore wing.
10. *Amphipsyche delicata*, part of hind wing.
11. *Polymorphanisus tumidus*, part of fore wing.
12. *Polymorphanisus tumidus*, head from side.
13. *Amphipsyche magna*, tip of penis and clasper.
14. *Œstropsyche vitrina*, median cell of fore wing of male.
15. *Amphipsyche apicalis*, genitalia, side.
16. *Amphipsyche magna*, superior plate, above.
17. *Amphipsyche magna*, fore wing of male.

PSYCHE VOL. XLVI PLATE 1



Banks — Oriental Œstropsychinæ



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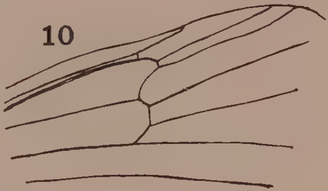

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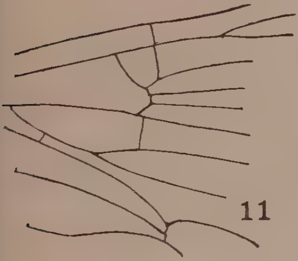

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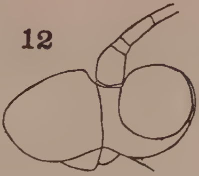

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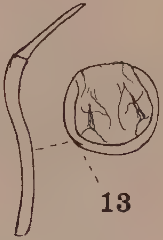

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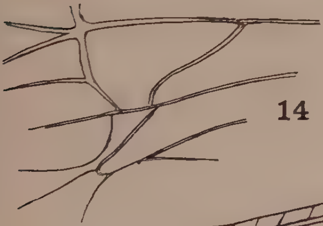

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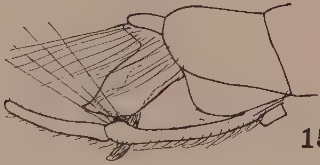

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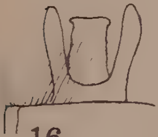

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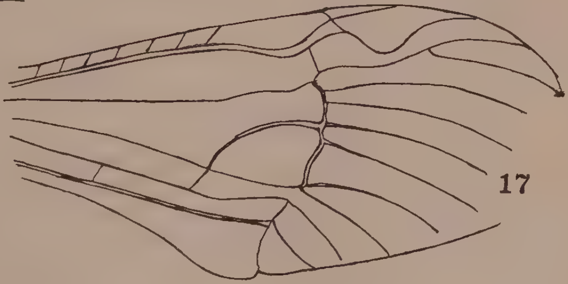

17

Banks — Oriental Œstropsychinæ

A PTILIID BEETLE FROM BALTIC AMBER IN THE MUSEUM OF COMPARATIVE ZOOLOGY

By C. T. Parsons

Biological Laboratories, Harvard University

In so far as no fossil *Ptiliidae* have as yet been given names, it may be of interest to describe a species of *Ptinella* from the Oligocene amber of East Prussia.

Helm, 1896, merely mentions the occurence of the family in Baltic amber, and Klebs, 1911, states on the authority of Edmund Reitter that there is in his collection a *Ptenidium* and a new genus.

Today the genus *Ptinella* has a remarkable range. The twenty known species are distributed as follows: Europe (7, 2 of which also occur in the Canary Islands), Japan (1), Honolulu (1), New Zealand (1), North America (2), Central America (3), South America (2), St. Helena Island (1), and the Seychelles Islands (2). Since such a distribution indicates an ancient history, it is not surprising to find the genus in the Oligocene. Moreover, the living forms most commonly occur under the bark of *Betula*, *Quercus*, and particularly *Pinus*, all of which were common in northern Europe in the Oligocene.

Ptinella oligocœnica n. sp.

Fig. 1, a-e

The characters of generic importance are brought together in one paragraph. Body elongate; antennæ 11-jointed, long and slender, with long setæ, club elongate; head prominent, rather large; eyes moderate; thorax rather small, transverse, and constricted near the base; scutellum large, triangular; elytra abbreviated, with apices separately rounded; venter of six segments, with apical segment simple; legs rather long and robust, posterior coxæ remote and apparently laminate, tarsi 3-jointed, with the apical joint very long and slender, claws long.

The body apparently corneous, somewhat depressed; head and antennæ as figured; outline of pronotum as figured, disc flat, surface sparsely punctate and transversely alutaceous, scutellum coarsely, closely punctate; elytra with discs flattened, humeral angles dentate, coarsely and closely punctate; metasternum sparsely punctate; first ventral segment punctate and as long as the following two combined; ventral segments 2-6 apparently smooth, apical segment with a fringe of hairs; femora and tibiæ covered with setæ; length .8 mm.

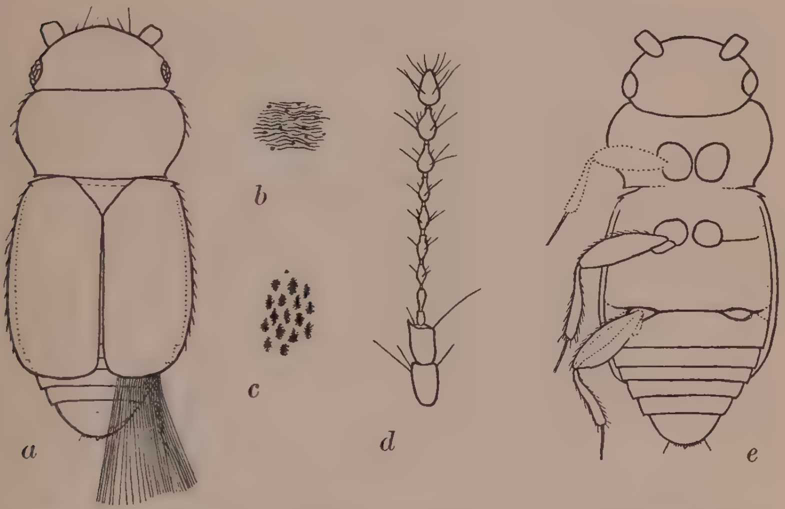

Fig. 1. Holotype of *Ptinella oligocœnica* n. sp. *a*, dorsal aspect; *b*, surface of pronotum enlarged; *c*, surface of elytron enlarged; *d*, antenna; *e*, ventral aspect.

The above description is from the holotype no. 6839 in the Museum of Comparative Zoology. There is also in the same museum a less satisfactory specimen which is designated paratype no. 6629. Both specimens are part of the W. A. Haren collection.

Because of cloudiness, many important characters of the underside cannot be seen. The one anomalous character that can be made out is that the first ventral segment is unusually long. It is interesting that the muscles of the femur, as shown in the drawing of the hind leg, can be clearly seen.

This species differs from the types of *P. quercus* (Lec) and *P. fungi* (Lec.) in being more depressed, corneous, elytra longer, pronotum more transverse. The antennæ are identical with those of *P. quercus*.

PROTEPIPTERA, A NEW GENUS OF ACHILIDÆ FROM BALTIC AMBER (HEMIPTERA, FULGOROIDEA)

By Robert L. Usinger
California Academy of Sciences

Through the kindness of Mr. Walter W. Kawecki, a former resident of the free city of Danzig but now in San Francisco, I have been able to examine a collection of insects preserved in Baltic Amber. The material was collected along the shores of the Baltic Sea between Danzig and Königsberg and the pieces of amber were polished by an amber worker in Danzig.

The collection contains a single specimen of a moderate-sized Fulgorid immediately suggestive of our familiar forest-dwelling genus *Epiptera* Metcalf (1922) (= *Elidiptera* Auct. part., nec Spinola, = *Helicoptera* Am. & Serv.). The specimen is beautifully preserved with the wings of the left side conveniently spread. Every detail of the under surface can be seen as readily as on a living specimen. The upper surface, however, is completely covered by a white cloud, as in many amber specimens. The apex of the front wing has been sharply broken off as if cut with a knife.

Evidently the family Achilidae has not previously been recorded from Baltic Amber. Scudder (1890) has doubtfully referred a single specimen (*Elidiptera regularis* Scudder) to this group from his Florissant material of Miocene age. However, the nine species of *Cixius* described from Baltic Amber by Germar and Berendt (1856) need to be reëxamined with a view to their possible inclusion in the Achilidæ. This family, or subfamily as it was then called, was not proposed until ten years later when Stål (1866) monographed the group in his usual masterly way. Stål's classification has been confirmed and expanded by Muir's detailed genitalic studies which indicate that the extension of the claval vein to the apex of the clavus is a really significant character in separating the Achilids from their nearest allies (Muir, 1930). The specimen before me may be placed with certainty in the Achilidæ as distinguished from the Cixiidæ in which the claval vein enters the commissure before the apex. Unfortunately details of claval venation are not sufficiently clear in the figures of Germar and Berendt although it would appear that *C. vitreus* is a Cixiid while *testudinarius* is an Achilid. In size the present specimen is closest to *C. sieboldii* but, as the under side is invisible in that species, while the upper surface of the specimen before me is obscured, a direct comparison is impossible. Under the circumstances it seems best to propose a new specific name in order to avoid any possible confusion as to the identity of the genotype.

Protepiptera n. gen.

Similar to *Epiptera* Metcalf but with the vertex located distinctly in front of the eyes, its margins carinate and a longitudinal carina at middle; posterior margin of vertex concavely arcuate, subangulately so at middle, strongly, acutely produced postero-laterally and thus reaching or slightly surpassing level of anterior margins of eyes. Frons with its sides evenly arcuate, not abruptly narrowed between the eyes. Pronotum roundly projecting anteriorly between the compound eyes, the raised, carinate portion scarcely more than twice as broad as long.

Genotype: *Protepiptera kaweckii,* n. sp.

Protepiptera kaweckii n. sp.

A large, unicolorous species with very broad head, long pronotum, unicolorous frons, and very long rostrum.

Head three-fourths as wide, eyes included, as pronotum; vertex just twice as broad behind as long on median line; frons and clypeus together subelliptical, broadest a little before middle and attenuated posteriorly, about two and one-half times as long as greatest width, with a distinct longitudinal carina at middle. Rostrum reaching almost to tip of abdomen or, more precisely, to middle of subgenital plate. Antennæ rather prominent, over half as long as greatest width of frons; second segment over twice as long as first, the flagellum quite short, scarcely longer than main portion of antennæ. Ocelli conspicuous as in *Epiptera.* Posterior margin of pronotum moderately, subangulately emarginate, the anterior and posterior margins laterally subparallel. Mesonotum one-fifth longer than width of head including eyes; disk obscured but with suggestions of three longitudinal carinæ. Legs more or less as in typical *Epiptera,* the front tibiæ one-sixth longer than femora. Posterior tibiæ two and one-half times as long as femora, each with a strong lateral tooth just beyond middle. Apices of hind tibiæ and first two tarsal segments beneath, each with a row of stout spines which are longest at the sides. First tarsal segment distinctly longer than second and third together. Venation on basal two-thirds of front wings precisely as in *Epiptera,* the wing broken off obliquely from beyond the apex of clavus to last of accessory subcostal branches.

Color rather uniformly dark brown, at least on the under side, with the under sides of the wings lighter and the ventral surface of the abdomen almost black.

Length 9.5 mm., greatest width approximately 3.5 mm.

This species will not fit in any of Kirkaldy's Australian genera (1906). It might fit the old definition of *Elidiptera* but certainly does not belong with the genotype, *callosa* Spinola, of that genus (see Muir, 1922). As noted elsewhere, it approaches Metcalf's recent genus *Epiptera* (1922) but differs in its anteriorly located vertex with a median longitudinal carina, non-constricted basal portion of frons between the eyes, very long pronotum, and somewhat longer tibiae.

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TWO NEW TINGITIDS (HEMIPTERA) FROM PANAMA

By Carl J. Drake

Ames, Iowa

The present paper contains the description of two new species of lace-bugs collected in the Canal Zone, Panama, by the author. The types are in the Drake Collection.

Gargaphia paula sp. nov.

Moderately short, broad, testaceous, the elytra with an oblique fuscous band near the apex. Head black, with five, pale, testaceous spines, the median and hind pair longer. Antennæ slender, moderately long; segments I and II black, the former stouter and three times as long as the latter; III long, testaceous, two and one-half times as long as IV; IV long, the distal three-fourths black. Pronotum black, the triangular portion testaceous. Carinæ foliaceous, testaceous, uniseriate; lateral carinæ not quite extending as far forward as the base of the hood, slightly converging behind; median carina slightly more elevated. Hood moderately large, roof-shaped above, highest in front, projecting slightly forward in front. Paranota moderately broad, testaceous, biseriate, the outer margin rounded.

Rostrum extending to the interrupted channel. Elytra very similar in appearance and markings to *L. lineata* (Champ.); costal are mostly biseriate, triseriate in widest part, the areolæ hyaline; subcostal area broad, triseriate in widest part. Body beneath black.

Length, 2.40 mm.; width, 1.10 mm.

Holotype, male, Barro Colorado Island, Canal Zone, Panama, Feb. 8, 1939, C. J. Drake.

The oblique fascia of the elytra and the small size separate this species from other members of the genus. The interrupted rostral channel separates it from *Leptopharsa lineata* Champion.

Leptopharsa zeteki sp. nov.

Small, narrow. Head black, the frontal spines short and black. Antennæ moderately long, slender; segments I and II both short, black, the former about twice as long as the latter; III a little more than twice as long as IV, testaceous; IV slightly enlarged, embrowned towards the tip. Rostrum brown, black at apex, extending beyond middle of mesosternum. Rostral channel wide, wider and chordate on metasternum. Legs slender, testaceous, the tarsi brownish. Body beneath black.

Pronotum convex, finely pitted, black, testaceous behind; carinæ foliaceous, uniseriate, testaceous, some of the veinlets dark, the areolæ small; lateral carinæ slightly concave within in front, not so widely separated and subparallel behind. Paranota rather narrow, biseriate, testaceous, slightly wider in front, moderately reflexed. Hood small, testaceous, faintly produced forward in front. Elytra moderately constricted beyond the middle, strongly overlapping and jointly rounded behind; costal area moderately wide, testaceous, biseriate, the inner row of areolæ along the basal half of costal area smaller, the areolæ hyaline; subcostal area broad, triseriate, the veinlets opposite discoidal area black; sutural area elongate, impressed, the nervelets somewhat embrowned, three areolæ deep in widest part; sutural area becoming dark fuscous posteriorly, with three large, hyaline areolae near the apex.

Length, 2.00 mm.; width, .80 mm.

Holotype (male), allotype (female) and one paratype, Barro Colorado Island, Canal Zone, Panama, Feb. 1939. Three paratypes, near Colon, Canal Zone.

The short basal segment of antennæ and color separate this insect from other small species of the genus. This species (also *G. paula* n. sp.) was collected near the Barro Colorado Island Biological Laboratory, Gatun Lake, Institute for Research in Tropical America, Panama Canal, and is named in honor of the Director, Mr. James Zetek, who has taken a very active interest in the insect fauna of tropical America.

NOTES ON HIPPOBOSCIDÆ
13. A SECOND REVISION OF THE HIPPOBOSCINAE

By J. Bequaert

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Boston, Mass.

Since the publication of my synopsis of the Hippoboscinæ (1931, Psyche, XXXVII, (1930), pp. 303-326), much additional information has come to light. One new species was described recently by the late G. A. H. Bedford and I was able to study several types, including those of *H. fulva* Austen.

In the alphabetical list of names (p. 306), *martinaglia* Bedford should be inserted as the ninth valid species; *longipennis* Fabricius is the valid name of *capensis* v. Olfers, which becomes a synonym; and *variegata* Megerlé (not to be credited to Wiedemann) is the valid name of *maculata* Leach, which passes in the synonymy.

As pointed out before, the Hippoboscinæ differ from other members of the family in several important characters. To those listed before may be added the presence of a pair of deep, more or less pit-like depressions, placed laterally on the suture between mesonotum and scutellum; also the well-defined pale yellow or white spots of head and thorax, which are not duplicated elsewhere in the family. While in other Hippoboscidæ color differences are of little or no specific value, in *Hippobosca* the shape and arrangement of the pale spots produces a pattern to a large degree diagnostic for each species. In this respect, there is an obvious analogy to the characteristic pattern of pale spots found in many species of ticks (*Amblyomma* and *Dermacentor*).

I have been at pains to discover additional specific characters, particularly in the case of closely allied forms. The chetotaxy has been neglected thus far, yet offers reliable differences which should be investigated by the accepted biometrical methods. My material is not extensive enough for the purpose. Considering only the chetotaxy of the scutellum, this sclerite in *Hippobosca* bears at the extreme apical margin and somewhat ventrally a dense fringe of short, soft hairs. Anterior to the fringe one finds groups or rows of long, stiff bristles, either black or pale-colored, which I shall call the *preapical bristles.* The groups may be either far apart and restricted to the extreme sides or more or less connected medially. In some species the bristles are placed in one row, in others they form two irregular rows or are merely bunched together. When there are many bristles, these are often mixed with a few soft, short hairs, sometimes forming a second row behind the stiff bristles. In most cases the number and arrangement of the preapical bristles is the same in both sexes. There are two exceptions. In *H. struthionis* the males have more bristles on the average than the females. In the males of *H. camelina* the preapical bristles occupy the same position as in the other species of the genus; but in the females, the bristles are placed nearer the middle, being rather discal or medio-scutellar, and are also fewer in number than in the males. Except for this case of the female *H. camelina,* there are no discal nor basal bristles, setæ or hairs on the scutellum in *Hippobosca.*

The variation of the preapical bristles of the scutellum is discussed under each species, but the following summary compares the species for diagnostic purposes. The number of specimens examined is given in parenthesis.

equina (106) : 5 to 11 bristles ♀ ♂ (average, 7).
longipennis (143) : 3 to 7 bristles ♀ ♂ (average, 5).
fulva (3) : 8 bristles ♀ ♂.
variegata (95) : 13 to 27 bristles ♀ ♂ (average, 18).
rufipes (95) : 12 to 23 bristles ♀ ♂ (average, 17).
hirsuta (6) : 14 to 18 bristles ♀ ♂.
martinaglia (not seen).
struthionis (23) : 4 to 12 b. ♀ (average, 6) ; 8 to 15 b. ♂ (average, 10).
camelina (31) : 3 to 8 b. ♀ (average, 5) ; 11 to 22 b. ♂ (average, 14).

In *Hippobosca,* the integument of the abdomen, behind the usual large tergal and small sternal sclerotized basal plates, is mostly soft and extensible. All species I have seen have two pairs of sclerotized subapical (lateral) plates in both sexes. In the males of *equina* and *longipennis*, the anterior pair is small and fused with the median tergal plate, yet recognized by the very long setæ it bears. In addition, these two species have in both sexes three median tergal sclerotized plates, which are much smaller in the female than in the male. Median tergal plates are lacking in both sexes of *variegata, rufipes, struthionis,* and *hirsuta,* and in the female of *camelina.* The male of *camelina,* however, has an extensive anterior sclerotized median plate, immediately behind the basal tergal sclerite of the abdomen, and posteriorly a pair of small, median tergal plates. In the female of *longipennis* and *equina* the anterior pair of subapical (lateral) plates is slightly smaller than the posterior pair; it is larger than the posterior pair in the female of *variegata, hirsuta, camelina* and *struthionis;* and both pairs are about the same size in the female of *rufipes.* In the males of *variegata, rufipes, hirsuta, camelina* and *struthionis,* the anterior pair of subapical plates is very large, the posterior pair very small and readily overlooked. I have not examined the structure of the abdomen of *fulva* and *martinaglia.*

In the male genitalia, the claspers (or parameres) are very similar in *equina, longipennis, fulva, variegata, rufipes* and *struthionis,* being more or less slender, straight and rod-like, ending in a point. In *camelina* they are of much the same rod-like type, but thicker, curved in profile and ending in a blunt, somewhat knobbed point. They are quite aberrant in *hirsuta,* being thick and beam-like, with a broadly truncate and slightly emarginate tip. The genitalia of *martinaglia* are unknown.

To sum up, the nine species of *Hippobosca* now recognized may be divided into four groups, expressing relationship based on structural characters: (1) *equina, longipennis* and *fulva;* (2) *variegata, rufipes, hirsuta* and possibly *martinaglia;* (3) *struthionis;* (4) *camelina.*

The following key supersedes that of my earlier paper (pp. 308-309). *H. martinaglia* is inserted from the description only.

1. Second longitudinal vein (R_{2+3}) long, about as long as or longer than last section of third longitudinal, reaching costa much beyond tip of first longitudinal

(R_1) and usually apicad of anterior cross-vein (r-m); last section of costa about three times the length of penultimate section or shorter. Base of third longitudinal vein (R_{4+5}) bare. One pair of vertical bristles. Preapical bristles of scutellum few (3 to 11). Abdomen with three median tergal sclerotized plates in both sexes (in *equina* and *longipennis;* not known in *fulva*). Two pad-like pulvilli at sides of bristle-like empodium, one much larger than the other. Parameres of male genitalia slender, rod-like, ending in a point 2

Second longitudinal vein short, shorter than last section of third longitudinal, reaching costa together with or close to tip of first longitudinal; last section of costa at least five times the length of penultimate section.... 4

2. Larger species, the wing 6 to 8.5 mm. long. Apical lobes of fronto-clypeus irregularly and broadly triangular, their inner margins curved. Scutellum fuscous to ferruginous laterally, yellowish-white medially, rarely more extensively yellowish; with a regular row of 5 to 11 preapical bristles (usually 6 to 8), divided into two groups. Wing veins as a rule rufous to dark brown .... *H. equina*

Smaller, the wing at most 6 mm. long. Scutellum as a rule entirely or nearly entirely yellowish or ivory-white 3

3. Wing 5 to 6 mm. long. Apical lobes of fronto-clypeus regularly and sharply triangular, separated by a broad notch, their inner margins nearly straight. Scutellum with 3 to 7 preapical bristles (usually 5 or 6). Wing veins mostly pale testaceous, usually with some darker stretches .... *H. longipennis.*

Wing 4.2 to 4.5 mm. long. Apical lobes of fronto-clypeus irregularly and broadly lobular, separated by a narrow slit, their inner margins curved. Scutellum with about 8 preapical bristles .... *H. fulva*

4. Base of third longitudinal vein (R_{4+5}) setulose over some length on the upper side. One pair of vertical bristles. No median tergal plates in both sexes (in *variegata, rufipes* and *hirsuta;* probably also in *mar-*

tinaglia). Only one pulvillus well-developed, the other rudimentary 5

Base of third longitudinal vein bare 8

5. Second longitudinal vein very short, forming an oblique cross-vein which ends in the first longitudinal and runs from opposite or apicad of upper tip of anterior basal crossvein (M_3) to basad of anterior cross-vein (r-m). Frons distinctly narrower at occiput than at fronto-clypeus, the postvertex much longer than wide. Scutellum as a rule with three ivory-white spots, the largest in the center; with 13 to 27 preapical bristles (usually 16 to 20), in one or two irregular and fairly continuous rows. Parameres of male genitalia slender, rod-like, ending in a sharp point. Wing 7 to 8 mm. long .... *H. variegata.*

Second longitudinal vein longer and more slanting, ending in costa at or beyond tip of first longitudinal and running from basad of upper tip of anterior basal cross-vein to opposite or basad of anterior cross-vein 6

6. Smaller, the wing 4.5 mm. long. Frons wide, not appreciably narrower at occiput than at fronto-clypeus, the postvertex much wider than long. Mesonotum reddish-brown, with an anterior median dark band extending posteriorly to near the transverse suture where it is more or less forked. Scutellum entirely yellowish-white; with relatively few (probably eight to ten) preapical bristles. Mesonotum moderately bristly, bare in the center .... *H. martinaglia*

Larger, the wing 6.5 to 9 mm. long. Frons narrower, the postvertex nearly as long as wide or slightly longer. Color pattern of mesonotum different. Preapical bristles of scutellum more numerous (12 to 23) 7

7. Frons distinctly narrower at occiput than at fronto-clypeus. Scutellum very wide and nearly rectangular, with a median, rufous and two lateral, ivory-white spots; with 12 to 23 heavy preapical bristles (usually 14 to 20), placed in one regular, almost continuous row. Mesonotum moderately bristly, bare in the cen-

ter. Legs bright reddish-brown. Parameres of male genitalia slender, rod-like, ending in a blunt point. Wing 7 to 9 mm. long .... *H. rufipes*

Frons very slightly or not narrower at occiput than at fronto-clypeus. Scutellum narrower and less rectangular, with a median ivory-white spot; with 14 to 18 soft and pale preapical bristles, placed in two irregular, more or less connected groups. Mesonotum very bristly, also in the center. Legs rufous-yellow. Parameres of male genitalia thick, beam-like, truncate and slightly emarginate at tip. Wing 6.5 to 8 mm. long .... *H. hirsuta*

8. Two or three pairs of vertical bristles. Fronto-clypeus shorter than its distance from the occipital margin. Postvertex shorter than mediovertex, the latter much narrowed medially by the broad inner orbits. Anterior basal cross-vein (M_3) very oblique and nearly its own length from anterior cross-vein (r-m). Scutellum semi-elliptical, the hind margin distinctly convex and slightly projecting medially; in the female with 3 to 8 discal bristles (usually 4 to 6), placed in two linear groups; in the male with 11 to 22 preapical bristles (usually 12 to 15), placed in two irregular groups. No median tergal plates in the female; the male with one large median plate behind the basal tergal sclerite and a pair of small median tergal plates posteriorly. No pad-like pulvilli; bristle-like empodium bare, except at base. Parameres of male genitalia rod-like, but curved upward, the apex slightly swollen and knob-like. Wing 9 to 10 mm. long .... *H. camelina*

One pair of vertical bristles. Fronto-clypeus nearly as long as its distance from occipital margin. Postvertex as long as or longer than mediovertex, the latter moderately narrowed by the inner orbits. Anterior basal cross-vein short, almost vertical upon the fourth longitudinal and more than twice its length from anterior cross-vein. Scutellum nearly rectangular, the hind margin more straightly truncate; in both sexes with preapical bristles placed in two widely separated lateral groups, more numerous in the male

(8 to 15, usually 9 to 12) than in the female (4 to 12, usually 5 to 7). Abdomen in both sexes without median tergal plates. Two pad-like pulvilli; empodium feathered. Parameres of male genitalia slender, rod-like, ending in a sharp point. Wing 7 to 7.5 mm. long .... *H. struthionis*

1. *Hippobosca equina* Linnæus.—The locality "Reshadie" is near Smyrna.

Additional Specimens Examined.—Norway: Smaalenene.—Esthonia, one female off a duck, *Mergus* (or *Merganser*) *serrator* Linnaeus (sent by G. B. Thompson), an accidental host.—Finland: Kustö (C. Lundström).—Denmark: Seelland (Univ. Zool. Mus., Copenhagen).—Austria: Grünbach, Schneeberg region (Handlirsch).—Hungary.—Roumania: Bihar Mts. (K. Jordan); Herkulesbad (W. Rothschild and E. Hartert).—Bulgaria: Aladza near Varna; Bela Cerkva, Rhodope (Zerny).—Jugo-Slavia: Zljeb, New Montenegro; Stolac, Herzegovina (Penther); Bosnia.—France: Argentat, Auvergne, off a cow.—Italy: Triest; Taranto; Pola.—Corsica: Vizzavona (M. E. Mosely); Corte (M. E. Mosely); La Poce de Vizzavona (Yerbury); Ajaccio (F. Gugliemi).—Spain: Murcia (G. L. Boag); Sierra de Guadarrama, 6,000 to 8,000 ft. (B. Uvarov); Algeciras (Zerny); Noguera near Albarracin, Aragon (Zerny).—Canary Islands: La Caldera, Las Palmas Id. (W. M. Wheeler); Sa Cruz, Teneriffe; Puerto Cabias, Buenaventura.—Madeira (Lowe).—Albania: Kula Ljums; Hodzha near Prizren; Pashtrik; Korab; Durazzo.—Greece: Stavros, Macedonia (J. Waterston); Saloniki (J. Waterston); Helmas (Fonberg); Taygetos; Koystallopyghi (A. H. G. Alstoni); Attica; Poros; Vrissula; Mt. Pangaion; Struma; Carvalli (R. C. Shannon).—Asia Minor (Anatolia): Namerun; Cilician Taurus (Prince Abersperg); Sabandscha to Eskischebir; Ephesus.—Transcaucasia: Sagalu on Lake Göktschai (Zugmayer).—Turkestan.—Persia (Iran): Nissa, Elburs Mts. (Brandt); Tsiang-Kanspe, E. Persia (A. Teufigi); Enzeli, N. W. Persia (P. A. Buxton).—Arabia: Akaba, Hejaz (W. M. Mann).—Palestine: Haifa (P. J. Barraud); Beisan, Jordan Valley (P. A. Buxton).—Cyprus: Limasol (G. A. Mavromoustakis).—Egypt: Tisfa (Zool. Dept. Univ. Egypt).—

Libya: Dernah (Klaptocz). — Tunis: Gabes (Mik). — Algeria: Hamman Rirha; Hamman Meskoutine; El Kantara; Biskra (W. Rothschild and E. Hartert). — Morocco: Aguelman Sidi Ali bu Mohammed, Middle Atlas, 6,500 ft. (K. Chapman and J. W. S. Pringle); Ijoukak, Great Atlas, 3,900 ft. (K. H. Chapman and G. A. Bisset); Arround, Atlas, 1,950 m. (Ebner). — Australia: Sydney, on a horse imported from New Caledonia. — New Hebrides: Tanna Id. (E. Robertson); Vila, Efate (or Sandwich) Id., very common on horses (P. A. Buxton). — Philippines: Alabang, Rizal (M. B. Mitzmain). — Amboyna, off cattle (F. Muir). — Singapore (F. Muir).

The preapical bristles of the scutellum vary from 5 to 11 in 106 specimens examined (58 ♀ and 48 ♂), from 22 localities, 85 specimens having from 6 to 8 bristles. The specimens fall in the following groups: with 5 bristles: 3 (1 ♀, 2 ♂); 6b.: 28 (17 ♀, 11 ♂); 7b.: 22 (9 ♀, 13 ♂); 8b.: 35 (24 ♀, 11 ♂); 9b.: 10 (4 ♀, 6 ♂); 10b.: 7 (3 ♀, 4 ♂); 11b.: 1 (♂). There is no evidence of any sexual difference in this character. No locality is represented by enough specimens to make a further analysis of any significance. The bristles are evenly divided between both sides in 69 specimens, unevenly in 37, the uneven groupings observed being 2 + 3, 3 + 4, 3 + 5, 4 + 5, and 5 + 6.

The frons, in the male, is nearly parallel-sided and about as wide as an eye; in the female it is slightly widened medially, where it measures a little over the width of an eye.

In addition to the average larger number of preapical bristles of the scutellum, *H. equina* differs also from *H. longipennis* in the shape of the tergal plates of the abdomen. In the female of *H. equina*, the three median, setulose tergal plates are larger than in the female of *longipennis*, more transverse and ribbon-shaped, the median plate only slightly smaller than the hindmost plate, which is nearly as large as the anterior pair of subapical (lateral) plates. The median plates bear many more setae than in *longipennis*. In the male of *equina*, the three median tergal plates are large and ribbon-like, the hindmost (or third) plate fused with the anterior pair of ovate, widened subapical (lateral) plates (bearing longer bristles than the median plate proper). The shape and arrangement of the tergal plates are shown correctly by Ferris (1930, Philippine Jl. Sci., XLIII, p. 540, fig. 1 ♀, and p. 543, fig. 4*a* ♂).

The claspers (or parameres) of the male genitalia are slender, rod-like and regularly pointed at apex. They are figured in side view by J. I. Roberts (1927, Ann. Trop. Med. Paras., XXI, Pl. III, fig. 8); seen from above they are much narrower.

2. *Hippobosca longipennis* Fabricius, 1805. — A study of Fabricius' two types, marked "ex Tranquebar (Mus. Dom. Lund)", at the University Zoological Museum, Copenhagen, shows that they are the species commonly known as *H. capensis* v. Olfers (1816), *H. francilloni* Leach (1817), or *H. canina* Rondani (1878). Why Fabricius wrote "Caput et thorax ferruginea immaculata" is a mystery, as both his types show the characteristic *capensis* pattern. A specimen from Kalewa, Upper Burma, named "*longipennis*" by Major Austen, was studied at the British Museum and showed no structural characters differentiating it from the usual *H. capensis*. Fabricius' name antedates all other designations for the species, which is extremely variable in color. I have also seen, at the British Museum, a specimen of *H. francilloni*, apparently labelled by Leach and which may be the type, although it is not marked as such.

Additional Specimens Examined. — Bulgaria: Sredne near Russe. — Greece: Struma (R. C. Shannon). — Transcaucasia: Sagalu on Lake Göktschai (Zugmayer). — Transcaspia: Imam-Baba, Merv District (L. Mistschenko). — Persia (Iran): Keredj, 40 Kilom. from Teheran (Brandt); Dschulfa, N. W. Persia. — Mesopotamia (Iraq): Djerabis; Assur; Daurah (A. D. Fraser); Bagdad (T. C. Connor); Amara (T. C. Connor). — Syria: Beirut (E. S. Sewell). — Palestine: Amman, E. of Jordan (P. A. Buxton). — Arabia: Ras Fartak, Hadramaut (Simony). — Cyprus: Larnaca, off cow. — Egypt: Tisfa (Zool. Dept. Univ. Egypt). — Libya: Bengasi. — Tunis: Gabès. — Morocco: Marrakesh (G. B. Fairchild). — Anglo-Egyptian Sudan: Lugud, Darfur Province (H. Lynes); Khor Arbaat, Port Sudan. — Kenya Colony: Lake Jipe; Marsabit, Rendili Nyoro (C. A. Neave); Turkana District; Merifano (McArthur); Voi (Tate); Lemek, Masai Reserve (A. O. Luckman). — Tanganyika Territory: Valley of Ruaha River, N. Uhehe; Morogoro, Uluguru (A. G. Wilkins); W. shore of

Lake Manyara (B. Cooper); Mt. Meru, off lion (B. Cooper); Ngare Nairobi, W. Kilimanjaro, 4,500 ft. (B. Cooper); Shinyanga (N. C. E. Millar). — British Bechuanaland: Ngamiland (G. D. H. Carpenter); Ghanzi, Monfalatseka, Ngamiland, off dog (J. Maurice). — India: Quetta, Baluchistan (D. Harrison); Nedungadu (P. S. Nathan); Arbham, Vizagapatam (R. Senior-White); Chipurupalle, Vizagapatam (R. S. Patuck); Kangra Valley, Punjab (Dudgeon); Dehra Dun; Bangalore; Bhowali, Kumaon, 5,700 ft. (Imms); Allahabad; Bandra (Javakar). — Ceylon: Madulsima; Banhar (R. Senior-White); Trincomali. — Assam: Mungpoo, Reang River (R. Senior-White). — Indo-China: Than-Moi, Tonkin (H. Fruhstorfer). — China: Macao (F. Muir); Tshusiung, Yunnan, 1,900 m. (Handel-Mazzetti); Tsinan, Shantung (E. Hindle); Hanchow, off dogs (Rose); Kachek, Hainan Id. (L. Gressitt); Peiping; Yen-Ping. — Manchuoko (Manchuria): Harbin (Jettmar).

The preapical bristles of the scutellum vary from 3 to 7 in 143 specimens examined (79 ♀ and 64 ♂), from 23 localities, 126 specimens having 5 or 6 bristles. The several numbers are represented as follows: with 3 bristles: 1 (♂); 4b.: 3 (1 ♀, 2 ♂); 5b.: 19 (11 ♀, 8 ♂); 6b.: 107 (60 ♀, 47 ♂); 7b. 13 (7 ♀, 6 ♂). There is apparently no sexual difference in this character. The number from any one locality is too small for further analysis. The bristles are evenly divided in 110 specimens, unevenly in 33, the uneven groups observed being 1 + 2, 2 + 3, and 3 + 4.

H. longipennis differs from *H. equina* in the shape of the tergal plates of the abdomen, the difference being more striking in the male than in the female. In the female of *H. longipennis* the three median, setulose sclerotized plates are very small, ovate or reniform, the second smaller than either the first or the third, the third much smaller than the anterior pair of subapical (lateral) plates. In the male, the three median plates are large and ribbon-like, much of the same shape as in the male of *H. equina;* but the hindmost (or third) plate is connected laterally with a pair of small, attenuated lateral subapical plates (recognizable by their bearing longer setae than the median plate proper). No adequate figures of this species have been published.

The claspers (or parameres) of the male genitalia are very similar to those of *H. equina*.

Historical Note. — There is every reason to believe that *Hippobosca longipennis,* the dog-fly of the Near and Far East, was well known by the ancient Greeks and Romans, as it is particularly abundant in the countries bordering the eastern Mediterranean. Many are the references to "*kunamuya*" (in Greek) or *Cynomya* in the classic literature and early scientific writings. Thus, in the Iliad, Ares, the god of war, upbraids Athene: "You dog-fly, why do you sow strife among the Gods? . . ." (Bk. 21, 394). Elsewhere (Bk. 21, 421) Athene exclaims: "Now watch that dog-fly [meaning Aphrodite] leading Ares through the free-for-all. . . ."[1] I am also inclined to think that the Greek word "*kunoraistai*" or dog-destroyers, used in the Odyssea (XVII, 300) and later by Aristoteles, covered the ectoparasites of dogs in general, hippoboscid flies as well as ticks. Oudemans (1926, Tijdschr. v. Entom., LXIX, Suppl., pp. 49-59) claims that both "*kunoraistai*" and "*kunamuya*" were used by the Greeks for dog ticks only (*Ixodes reduvius* Linnaeus). He is evidently unaware of the abundance of *Hippobosca longipennis* on dogs in the Orient. It seems most improbable that the Greeks would have called a tick a fly, since they had a special word for ticks ("*krotones*") and must have been well acquainted with both types of parasites. Moreover, the hippoboscid attracts more readily the attention and is more loathsome to the layman than the tick, owing to its habit of scurrying about in the fur and of flying from one dog to another or even onto people. Hence the use of the word "dog-fly" as a reviling or scurrilous epithet.[2]

[1] The exact dating of the collection of epic poems now called the Iliad and credited to Homer is a matter of speculation. Probably they had more or less crystallized into their present form by the eighth century B. C.

[2] Oudemans also claims that the "*muscæ*" or flies mentioned by Varro, Columella, Plinius and others as causing sores in dogs, were ticks. But in warm countries certain biting flies, such as *Stomoxys* and *Phlebotomus*, may cause true sores on the ears of dogs. Oudemans is apparently also mistaken in criticizing Albertus Magnus' use of the expression "muscæ bestiarum, quae dicuntur *cynomiæ sive muscæ caninæ*" (De Animalibus Libri XXVI, 1260). Albertus, in my opinion, alluded correctly to the winged hippoboscids which in southern Europe infest horses and cattle, as well as dogs; the two species being so much alike that laymen would naturally call them by the same name. In his second volume, Oudemans (1929, pp. 150-151) is quite elated over

Dr. Gaines Kan-chih Liu has called my attention to references to dog-flies in the early Chinese medical literature and has kindly translated some of these for my paper. In the *"Chi Tung Yeh Yu,"* by Chow Mi (who lived 1232 to 1308), one reads: "A colleague of mine, Chen P'o, of Quo Chang, is an old scholar. His grandson, when three years old, was seriously ill with fever for a week, after which "*to*" (or small-pox) broke out, the whole body turning black and the lips being icy cold. After all remedies had failed, the grandfather went to the temple to pray God for help. There he met a stranger, who, upon learning of the case, told the grandfather how to cure it. The prescription consisted of seven dog-flies, ground into a powder and taken with wine. The medicine was very effective and the child soon was in good health, the black color disappearing." In the later "*Pen Tsao Kang Mu*" (1578), by Li Shih-chen, one finds: "Dog-flies live on the body of the dog. They can fly, are yellow and fly-like and have a hard skin. They have a sharp beak and suck the blood of the dog. Formerly they were not known to be used in Medicine; but recently they have been recommended by the *Chi Tung Yeh Yu* for curing small-pox and by the *Yi Fang Da Chien* for malaria. It seems to me that they must act like the cattle-lice and the *chufoo* (or sawbugs). For malaria, the flies, after removal of the appendages, are made into pills with dough. They should be taken the morning of the day an attack of fever is due and the cure will be successful if vomiting is provoked. Another method is to make the flies into pills with wax and take the pills with wine. For small-pox and skin troubles, soak the fly in wine and then take both the fly and the wine." Finally the "*Chien Wu*" (1582), by Li Su, says: "The dog-flies deposit among the hairs of the dog their nits (puparia), which after molting become flies. They always live on the back of the neck, where they bite frequently and where the dog cannot reach them with its mouth or paws."

3. *Hippobosca fulva* Austen. — Through the courtesy of

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his discovery that the Archbishop Eustace of Saloniki, in his Commentary of the Iliad, suggests that the Greek word "*kunamuya*" (which he proposes to emend to "*kunomuya*") evidently meant the tick. But this statement proves only that the Archbishop was more proficient in philology than in natural history.

the late Major Austen, I was able to examine the holotype and paratype at the British Museum. This species, which has not been figured, is close to *H. longipennis*, the most important differences being given in the key. In addition, the vertex is somewhat narrower than in *longipennis*, with the inner margins slightly converging toward the occiput; the postvertex is shorter; the inner orbits (or parafrontalia) are narrower and of more uniform width throughout; the fronto-clypeus also narrower. The insect is mostly reddish-yellow; but scutellum, postvertex and fronto-clypeus are almost wholly pale ivory-yellow. I have seen also a male from Tanganyika Territory (West shore of Lake Manyara). This sex is almost exactly like the female. It has eight strong pale-colored preapical bristles on the scutellum (also present in both types), placed in a single row and widely divided into two groups of four each. The structure of the abdomen is not known, but is probably similar to that of *equina* and *longipennis*, with minor differences in the relative size of the median tergal plates.

In the male of *fulva* examined, the parameres of the genitalia are similar to those of *equina* and *longipennis*, but the terminal point is blunter. *H. fulva* and *H. martinaglia* are the smallest members of the genus.

4. *Hippobosca variegata* Megerlé von Mühlfeld, 1803, (actual date of publication!), Appendix ad Catal. Insect. Nov. 1802 Viennae Austriae Vendita, p.[14] (unnumbered) (Bengal).

Synonyms: *H. maculata* Leach, 1817; *H. bipartita* Macquart, 1843; *H. aegyptiaca* Macquart, 1843; *H. fossulata* Macquart, 1843;[1] *H. sudanica* Bigot, 1884; *H. sivae* Bigot, 1885; *H. calopsis* Bigot, 1885; *H. aegyptiaca* var. *bengalensis* Ormerod, 1895.

H. variegata appears to be the oldest valid name for this species, the date 1823 given by Wiedemann being erroneous (see Schenkling 1935, Arch. Morph. Taxon. Entom., Berlin-Dahlem, II, p. 156). The original description is of the briefest: "ex Beng. Aff. equin. sed maj. magisque varieg. (1 Exemplar)." Yet it is sufficient to validate the name, especially in view of the fact that Wiedemann (1830,

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[1] Macquart's three names should be dated 1843, when the Mém. Soc. Sci. Lille for 1842 were actually published.

Aussereurop. Zweifl. Ins., II, p. 603) based the more detailed and fully recognizable description of his *Hippobosca variegata* in part upon Megerlé's specimen.

I have seen, at the University Zoological Museum in Copenhagen, the fly from Tranquebar mentioned by Fabricius (1805, Syst. Antliat., p. 338) as a variety of *H. equina.* It is *H. variegata* and may well have been the specimen which Wiedemann mentioned from Tranquebar. I have also seen Leach's type of *H. maculata* at the British Museum. According to the label it came from Bengal.

Additional Specimens Examined. — French West Africa: Zinder, Niger River, off cattle and horses (A. Buchanan). — Gold Coast: Salaga, N. Terr., off cattle (F. J. A. Beringer); Yegi, N. Terr.; Accra (J. W. S. Macfie); Obuasi, Ashanti (W. M. Graham). — Northern Nigeria: Kaduna (J. J. Simpson); Azare (L. Lloyd); Zungeru, off horses. — Southern Nigeria: Lagos (C. B. Philip); Olokemeji, Ibadan. — Cameroon: Bamum. — Belgian Congo: Sankuru District, 5° S., 26° E. (A. Yale Massey). — Anglo-Egyptian Sudan: Khor Hanoieit, Port Sudan; Khartoum (S. Hirst); Erkowit, Red Sea Hills, biting man (J. G. Myers); near Meshra, Equatoria biting man (J. G. Myers). — Egypt: Luxor (Reimoser.) — Ethiopia: Hawash River, W. of Mt. Zaquala, 6,000 ft. (J. O. Couper); Maraquo (O. Kovacs). — Uganda: Mt. Debasien, 5,000 ft. (A. Loveridge). — Kenya Colony: Nakuru (van Someren). — Tanganyika Territory: Kigonsera (J. N. Erth). — Natal: Durban. — Madagascar: Betsiriry District, west of S. Central Plateau, off mules (F. P. Porter); Tsaratanana, N. Central District (W. C. Holden); Ampoza (E. I. White); Tanovana, Oriental Forest District (between Tamatave and Tananarive. — C. Lamberton). — Mesopotamia (Iraq): Daurah (A. D. Fraser). — India: Calcutta (Brunetti); Bhowali, Kumaon, 5,700 ft. (Imms); Deccan (Fischer); Mukteswar, United Prov. (J. D. R. Holmes); Pusa, Bihar, off cattle (R. Senior-White); Tranquebar. — Ceylon: Banhar (R. Senior-White); Matale, off horse (R. Senior-White); Luduganga, off cattle (R. Senior-White); Habarane, off cattle (R. Senior-White); Peradenyia, off cattle (A. Rutherford); Dambula, off cattle (L. G. Saunders); Hamsantota; Madulsima; Diyawa, 4,000 ft. — Assam: Coonoor, off cattle (R. Senior-White);

Baranri (R. Senior-White). — Timor. — Celebes: Manado, off horse (F. C. Kraneveld).

The preapical bristles of the scutellum are pale-colored and unevenly developed, usually placed on two irregular rows, the two lateral groups more or less connected in the middle. Counting only the heavy bristles and neglecting the small, hair-like ones, their number varies from 13 to 27 in 95 specimens examined (49 ♀ and 46 ♂), from 12 localities, 68 specimens having from 16 to 20 bristles. The specimens show the following grouping: with 13 bristles: 2 (all ♀); 14b.: 1 (♀); 15b.: 5 (2 ♀, 3 ♂); 16b.: 7 (6 ♀, 1 ♂); 17b.: 15 (7 ♀, 8 ♂); 18b.: 15 (4 ♀, 11 ♂); 19b.: 22 (13 ♀, 9 ♂); 20b.: 9 (6 ♀, 3 ♂); 21b.: 7 (4 ♀, 3 ♂); 22b.: 2 (1 ♀, 1 ♂); 23b.: 3 (2 ♀, 1 ♂); 24b.: 4 (1 ♀, 3 ♂); 25b.: 2 (all ♂); 27b.: 1 (♂). There is seemingly no sexual difference in this character. In one lot of 30 specimens (10 ♀, 20 ♂) from Aden, off cattle, the bristles vary from 13 to 22, but 25 specimens have from 16 to 20 bristles. The bristles are evenly divided between both sides in 37 specimens, unevenly in 58, the uneven groupings observed being 6 + 7, 6 + 8, 7 + 8, 8 + 9, 9 + 10, 10 + 11, 11 + 12, 12 + 13, and 13 + 14.

In *H. variegata*, the dorsum of the abdomen bears no median tergal sclerotized plates in either sex. In the female, the anterior pair of subapical (lateral) plates is somewhat larger than the posterior pair. In the male, the anterior pair is very large, so that the two plates nearly touch medially; the posterior pair is very small and hidden in a dorsal view. The abdomen of the female is shown correctly by Ferris (1930, Philippine Jl. Sci., XLIII, p. 545, fig. 5). There is no good figure of the male.

The claspers (or parameres) of the male genitalia are straight and rod-like, rather abruptly narrowed about midlength and then very slender to the pointed tip.

5. *Hippobosca rufipes* v. Olfers.

Additional Specimens Examined. — Natal: Durban, off cattle (W. C. C. Pakes). — Cape Province: Van Rhyn's Pass (T.D.A. Cockerell); Milnertown near Cape Town (R. E. Turner); Waku (J. Bruce-Bays); Matjesfontein (R. E. Turner); Erraha (E. Gough). — South West Africa: Tsau, Great Namaqualand (Pöch); Otyivarongo, Damaraland (de

Schauensee); Windhoek to Gobabis (de Schauensee); Okahandja (R. E. Turner; J. Ogilvie); Otavifontein (K. Jordan); Usakos (J. Ogilvie); Hoffnung (K. Jordan). — Orange Free State: North Bank Halt, Norvals Poort (J. Ogilvie); Cotzies' Farm (W. L. Distant). — Bechuanaland Protectorate: Mongalatsela, Ghanzi, Ngamiland, off horse and off steinbok (J. Maurice). — Southern Rhodesia: Victoria Falls (R. Lowe Thompson). — Northern Rhodesia: Lunda, near Congo border (H. S. Evans). — Portuguese West Africa: Benguela, off cattle (W. C. C. Pakes). — Tanganyika Territory: Mt. Meru, 4,500 to 5,000 ft., off eland (B Cooper); Ngare Nairobi, W. Kilimanjaro, 5,000 ft. (B. Cooper); Ngaserai, W. Kilimanjaro, 3,000 ft. (B. Cooper).

The number of heavy, black preapical bristles of the scutellum is quite variable in this species and apparently shows no sexual difference. In 95 specimens examined (69 ♀ and 26 ♂), from 14 localities, the total number varies from 12 to 23, but 82 specimens have from 14 to 20 bristles. The specimens are distributed as follows: with 12 bristles: 2 (1 ♀, 1 ♂); 13b.: 5 (4 ♀, 1 ♂); 14b.: 10 (8 ♀, 2 ♂); 15b.: 10 (all ♀); 16b.: 7 (6 ♀, 1 ♂); 17b.: 17 (13 ♀, 4 ♂); 18b.: 18 (11 ♀, 7 ♂); 19b.: 12 (8 ♀, 4 ♂); 20b.: 8 (4 ♀, 4 ♂); 21b.: 5 (4 ♀, 1 ♂); 23b.: 1 (♂).

Most localities are represented by one or a few specimens. In a series of 67 specimens taken off cattle at Windsorton, Cape Province, the proportion is as follows: with 13b.: 3 (all ♀); 14b.: 4 (3 ♀, 1 ♂); 15b.: 9 (all ♀); 16b.: 5 (all ♀); 17b.: 12 (9 ♀, 3 ♂); 18b.: 15 (10 ♀, 5 ♂); 19b.: 8 (5 ♀, 3 ♂); 20b.: 5 (2 ♀, 3 ♂); 21b.: 5 (4 ♀, 1 ♂); 22b.: 1 (♂). The bristles are more often unevenly divided between both sides (unevenly in 58 specimens, evenly in 37), the two groups only narrowly divided, so that the row is fairly continuous. The uneven groupings observed were 6 + 7, 7 + 8, 8 + 9, 6 + 8, 7 + 9, 8 + 10, 9 + 10, 9 + 11, 10 + 11, 9 + 12, and 11 + 12.

The structure of the abdomen of *H. rufipes* is similar to that of *H. variegata*. It is correctly shown for the female by Austen (1909, Illustr. African Blood-Suck. Flies, Pl. XIII, fig. 100).

The parameres of the male genitalia are straight and rod-like, abruptly narrowed at basal third, beyond which they are thicker than in *H. variegata* and blunter at the pointed apex.

6. *Hippobosca hirsuta* Austen. — I have seen the types of the typical form and the var. *neavei* Austen at the British Museum.

Additional Specimens Examined. — Uganda: near Lake Albert (H. Hargreaves). — Nyasaland: Akamanga, Runyinya River, N. Nyasa, off waterbuck (J. B. Davey).

The preapical bristles of the scutellum are much weaker in this species than in most other members of the genus, and pale-colored. In the few specimens seen their total number varies from 14 to 18 (1 with 14, 1 with 15, 1 with 16, and 1 with 18, for the males; 1 with 14 and 1 with 16, for the females).

The structure of the abdomen is similar to that of *H. variegata* in both sexes.

The parameres of the male genitalia differ from those of all other species of the genus. They are broad and thick, beam-like, slightly wider basally and apically in side-view. The apex is straightly truncate, shallowly and evenly emarginate, so as to produce two blunt edges, one dorsal and one ventral.

7. *Hippobosca martinaglia* Bedford, 1936, Onderstepoort Jl. Vet. Sci. An. Ind., VII, pt. 1, p. 67, fig. (on p. 68) (♀ ♂ ; off Impalla, *Aepyceros melampus* (Lichtenstein); Bar R. Ranch, Swaziland, South Africa).

In the absence of specimens, I have inserted this species in my key on the assumption that there are setæ on the basal section of the third longitudinal vein and that only one of the pulvilli is well-developed, neither character being mentioned by the author. From the figure and description, it appears to be closest to *H. hirsuta*, likewise found on antelopes. It differs in the smaller size, the few short black setae of the mesonotum, the few preapical bristles of the scutellum, the wider frons, the narrower inner orbits or parafrontalia (less than half the width of the mediovertex or frontalia), and the short, semi-elliptical postvertex. The second longitudinal vein is described as "long", but the figure shows it to be "short", reaching the costa a short distance beyond the tip of the first longitudinal vein, so that the last section of the costa is about six times the length of the penultimate section. No median tergal plates are shown in the figure of the female. The coloration seems to fit some of my specimens of *H. longipennis* (*capensis*), but the second longitudinal vein is much shorter than in that species. The venation also separates *H. martinaglia* from *H. fulva,* a fly of about the same size, likewise found on antelopes.

The original description is reproduced, as it appeared in a periodical inaccessible to most entomologists: "A small species; length of wing 4.5 mm. Head about as wide at the occiput as at the fronto-clypeus, reddish-brown, the frontal stripe slightly darker; posterior margin of head fringed with minute, thick-set setæ, and a long seta at the base of each eye; palpi dark brown, clothed with short setae of the same colour. Thorax reddish-brown, with a median dark band extending backwards almost to the transverse suture; this band is forked posteriorly, usually more so than in the figure, and in one specimen is completely divided down the middle by a narrow line; on each side of the posterior portion of the median band there is a dark transverse band. On each side beneath the transverse suture there is a narrow transverse dark band, and beneath this a small triangular spot, which is usually indistinct and may be absent. At each latero-anterior angle there are two short setæ, one on each side slightly distad and nearer the meson; on each side above the base of the wing there are three very short, thick-set black setæ, two more similar setæ slightly above them and near the meson, and two larger setæ slightly above them and near the meson, and two larger setæ below them; on each side on the posterior margin there are five setæ. Scutellum yellowish-white, fringed with short and a few long setæ. On the venter there is a vertical dark band on each side between the fore and mid coxæ. Legs pale reddish-brown, sparsely clothed with setæ; those on the tibiæ and tarsi darker. Ungues black. Abdomen reddish-brown with numerous pale setæ. Wings hyaline with pale reddish-brown veins and short dark setæ on the costa. Second longitudinal vein (R_{2+3}) long, reaching beyond the apex of the first longitudinal vein (R_1), but not extending to the anterior cross-vein. This new species can be easily recognised by its pale colour and dark markings on the thorax and venter between the fore and mid coxae; also by the short thick-set setæ on the thorax and pale scutellum."

8. *Hippobosca struthionis* Janson. — I have seen the type from Mt. Stewart, Cape Province, at the British Museum.

Additional Specimens Examined. — Kenya Colony: Simba, 3,350 ft.; Makumbu; Ukamba; Machakos; Athi Plains, off horse; Merifano (McArthur); Taveta, off dog (C. W. Woodhouse). — Tanganyika Territory: Tabora, off ostrich (J. Rodhain); north of Tarengere River (W. A. Lamborn); Sanga River, Muruangani. — Transvaal: Pretoria; Deelfontein; near Limpopo River, N. Transvaal, off ostrich (R. A. Cooley). — Cape Province: Philipsdale, Worcester; Hopetown; Campbell; Cradock (Miss J. Brincker); Erreha (E. Gough). — Bechuanaland: Ghanzi, Ngamiland (J. Maurice). — South West Africa: Otavi (J. Ogilvie); Aus (R. E. Turner); Greater Spitzkopje near Usakos, Damaraland (de Schauensee).

This species is unusual in that the preapical bristles of the scutellum are crowded together in two widely separated groups, placed at the extreme sides; also in that the bristles are more numerous in the male than in the female. In 23 specimens (13 ♀ and 10 ♂) examined, from 4 localities, the bristles varied in the females from 4 to 12, 9 of the 13 ♀ having from 5 to 7; in the males, from 8 to 15, 7 of the 10 ♂ having from 9 to 12. The grouping was as follows: with 4 bristles: 2 (♀); 5b.: 3(♀); 6b.: 3 (♀); 7b.: 3 (♀); 8b.: 1 (♂); 9b.: 4 (1 ♀, 3 ♂); 11b.: 2 (♂); 12b.: 3 (1 ♀, 2 ♂); 13b.: 1 (♂); 14b.: 1 (♂); 15b.: 1 (♂). The bristles were divided into even groups in 8 specimens, unevenly in 15, the uneven groupings observed being 2 + 3, 3 + 4, 4 + 5, 5 + 6, 5 + 7, 6 + 7, and 7 + 8.

The structure of the abdomen of *H. struthionis* is similar to that of *H. variegata* in both sexes. The species has not been figured adequately.

The parameres of the male genitalia are slender, rod-like, gradually narrowed from the base to the pointed, sharp apex, and very similar to those of *H. equina*.

9. *Hippobosca camelina* Leach. — I have seen Leach's type, at the British Museum.

Additional Specimens Examined. — Morocco: Debdou-Taourirt (Ebner); Tendrara (Ebner). — Mauretania: Between Kiffa and Tidjidja, off camels (Mrs. Mary Steele). — Algeria: Biskra (Rothschild and Hartert); Ain Sefra (Rothschild and Hartert); Touggourt (Rothschild and Hartert); Oued Nça, Mzab country (Hartert); Zahrez Gharbi (Zerny). — Tunis: Gabes (Mik); Tozeur (G. F. de Witte). — Libya: Tripoli (Klaptocz); Dernah (Klaptocz); Bengasi (Klaptocz). — Egypt: Old Cairo, off horse (Efflatoun Bey); Gebel Elba, S. E. Desert (Tewfik); near Pyramids (Reimoser). — Palestine: Jericho (P. A. Buxton); Jerusalem (P. Barraud). — Arabia: Djedda (H. W. Whyte); Tuwaiq, Riyadh (H. St. J. B. Philby); Keshin (Hein). — British Somaliland: without more definite locality (C. L. Collenette). — Kenya Colony: Lodwar, Turkana; Marsabit, Rendili Nyoro, N. Frontier District (C. A. Neave); near mouth of Kallilokwelli River, Lake Rudolf (E. B. Worthington). — Anglo-Egyptian Sudan: Khor Hanoieit, Port Sudan; Erkowit, Red Sea Hills, biting man (J. G. Myers).

H. camelina is in many respects the most aberrant member of the genus, particularly in the arrangement of the scutellar bristles and in the structure of the abdomen, both features showing remarkable sexual differences. If few specimens were examined, one might be led to think that two species are confused under the name *camelina*. Fortunately I was able to study a series of 20 specimens (10 ♀ and 10 ♂), collected in one locality of British Somaliland, removing all doubt in the matter.

In the male the scutellar bristles are preapical, placed as in the other species of the genus. In 14 males examined, from 4 localities, their number varies from 11 to 22, with the following groupings: 11 bristles: 1; 12b.: 4; 14b.: 2; 15b.: 4; 16b.: 1; 17b.: 1; 22b.: 1. They are divided into two even groups in 6 males, unevenly in 8. In the female the bristles are discal, placed near the middle of the scutellum and much more spaced. In 17 females, from 6 localities, their number varies from 3 to 8, as follows: 3 bristles: 1; 4b.: 6; 5b.: 4; 6b.: 3; 7b.: 2; 8b.: 1. They are evenly divided in 10 females, unevenly in 7.

In the female the dorsum of the abdomen is entirely soft and extensible behind the usual basal tergal sclerite; posteriorly one finds on the extreme sides two pairs of subapical strongly sclerotized plates, bearing long bristles, the anterior pair being much larger than the posterior pair. In the male there is immediately behind the basal tergal sclerite a large ribbon-like median plate, somewhat triangular medially; much farther back, also a pair of very small median plates, rather far apart; two pairs of subapical plates are present, but the posterior pair are very small and hidden from view in a dorsal aspect. The abdomen is fairly correctly drawn for both sexes by Massonnat (1909, Ann. Univ. Lyon, N.S., CXXVIII, Pl. III, figs. 24 and 25).

The parameres of the male genitalia are peculiar. They are rod-like seen from above, but in side view more or less boat-shaped; the basal two-thirds are wide, with an evenly convex lower margin; the slender apical third is curved upward and ends in a blunt, somewhat knob-like point. The outer surface is raised into a median, curved, blunt ridge, running the whole length.

NOTES ON STRUMIGENYS FROM SOUTHERN OHIO, WITH DESCRIPTIONS OF SIX NEW SPECIES

By Laurence G. Wesson, Jr., and Robert G. Wesson

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The following paper is a list, with biological notes, of 14 species of the peculiar and little known genus, *Strumigenys*, six of which are new and are here described.[1] All the material was collected within 45 miles of Jackson, which is located centrally in southern Ohio.

Strumigenys (Cephaloxys) pergandei Emery

In a previous paper[2] it was shown that *S. pergandei* lives, in southern Ohio at least, near the colonies of various other species of ants, hunting the Collembola which often abound in the nests of these other species. Since the publication of that paper, we have found *S. pergandei* on more than 30 occasions in this region, and only once was it not obviously associated with another ant. Stray workers have been found in nest galleries of *Camponotus herculeanus* subsp. *pennsylvanicus* (Degeer), *Formica fusca* (L.), and *F. truncicola* subsp. *integra* Nyl. Three workers were found in an outlying gallery of a *F. fusca* mound. The gallery led from the mound to a small kitchen midden to which the *pergandei* seemed to be going, not, as experiments have indicated, for the debris there, but for the Collembola which lived about the refuse. Under a large, flat stone in maple woods was found a fine colony of *S. pergandei* in the center of a large *F. fusca* var. *subserica* Say colony the galleries of which surrounded the *pergandei* nest on all sides and below. Workers were observed in the galleries of about 28 additional nests of *Aphænogaster fulva* Roger under stones. Four or 5 *pergandei* workers could often be seen creeping away from the superficial galleries when a stone covering one of these nests was overturned. One such *fulva-pergandei* association was of special interest because of its similarity to the colony in the midst of the *F. subserica* nest described above. The *pergandei* were nesting in a shallow, nearly circular, earthen chamber about 3 cm. in diameter, immediately under a large, flat stone covering a colony of *A. fulva*. Large, flattened chambers and galleries of the *fulva* surrounded the *pergandei* nest for at least 8 cm. on all sides. The walls of the chamber separating the *Strumigenys* from the *Aphænogaster* were about ½ cm. thick. With one exception we have always found *S. pergandei* in the soil, that one exception being in the log mentioned below under *S. dietrichi* M. R. Smith.

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[1] We wish to express our deep appreciation to Dr. M. R. Smith, U. S. National Museum, for his suggestions as to the relationship of several of the new forms, as well as for his loan of much cotype material for comparison.

The types of the new species are to be deposited in the collection of the Museum of Comparative Zoology, Cambridge, Mass. Paratypes, when present, will be deposited in the collections of Dr. C. H. Kennedy, Ohio State University, Columbus, Ohio, Dr. W. S. Creighton, College of the City of New York, the U. S. National Museum, Washington, D. C., the American Museum of Natural History, New York, and the authors.

[2] Wesson, L. G., Jr., Contributions to the Biology of *Strumigenys pergandei* Em., Ent. News, vol. 47, pp. 171-174 (1936).

Some further notes from observations of this species are recorded here. The developmental periods are approximately: egg, 15 to 16 days; larval stage, about 42 days; pupal stage, about 18 days. On 3 occasions workers were seen to bring alternately left and right forelegs to the vertex of the head, rubbing the tarsi forward and placing them on the ground. Whether this was a cleaning operation or a means of transfering some substance to the substratum, or has some other significance is not known. The ant did not clean the tarsus after rubbing the head, nor did it rub any other part of its body. Workers of different colonies fight viciously when brought together. On the other hand, a colony will adopt the brood of another colony, even of a different species of the subgenus.

Strumigenys (Cephaloxys) ornato Mayr

Two workers were found near the kitchen midden of a colony of *Aphænogaster fulva* subsp. *aquia* (Buckley) which was nesting under a large stone in a rather moist hillside woods. Another colony was found in an almost identical situation in dense, oak woods. In the latter case a worker was first seen in a frequented gallery of *A. fulva aquia* under a large stone. The nest was located about 3 cm. to one side of the stone, and consisted of an irregular cavity, perhaps just a crack in the soil, barely beneath the humus. It contained not more than 20 workers. Both localities were in Pike County.

Strumigenys (Cephaloxys) deitrichi M. R. Smith

We have taken this ant in Pike, Lawrence, and Adams Counties. On 4 occasions workers were found under the bark of somewhat decayed logs in open, dryish woods. In all of these logs have been colonies of other species of ants, such as *Formica truncicola* subsp. *integra* Nyl., *Aphænogaster tennesseensis* Mayr, *A. lamellidens* var. *nigripes* M. R. Smith, *A. fulva* Roger, *Proceratium crassicorne* var. *vestita* Emery, *Ponera coarctata* subsp. *pennsylvanica* Buckley. One long, decayed, hickory log, covered with a tough layer of bark, was remarkable in containing colonies of at least 11 species of ants, including 5 species of *Strumigenys*. The log, lying on the edge of some woods, extended from deep shade through a clump of bushes into broken sunlight. The ant species, in approximate order from shade to sun, were: *Strumigenys deitrichi* M. R. Smith, *Ponera coarctata* subsp. *pennsylvanica* Buckley, *Aphænogaster fulva* subsp. *aquia*, Buckley, *Strumigenys pulchella* Emery, *Solenopsis molesta* (Say), *Strumigenys medialis* new species, *Strumigenys rostrata* Emery, *Proceratium crassicorne* var. *vestitum* Emery, *Lasius niger* var. *neoniger* Emery, *Strumigenys pergandei* Emery, and *Crematogaster lineolata* (Say). Several workers of *S. deitrichi* were found in the loose humus in the cedar grove described below under *S. missouriensis* M. R. Smith.

In none of these cases did we observe definite indications of an association between *S. deitrichi* and the other species of ants living near them, such as the presence of *deitrichi* workers in frequented galleries of the other.

Strumigenys (Cephaloxys) clypeata Roger

A nest of *clypeata* was found in the duff at the base of a small pine tree a few inches from a colony of *Myrmica* *punctiventris* Roger. The location was on a dry sandstone bluff in Jackson County on which many colonies of *S. pergandei* had been found.[3]

Strumigenys (Cephaloxys) medialis, sp.n.

Worker: (Pl. 3, fig. 1): Length, 2.00 mm.

Sides of head converging anteriorly, the occipital lobes posterior to the antennal insertions somewhat but not suddenly or strongly expanded; clypeus at greatest width ⅓ the length of the head exclusive of the mandibles, evenly and broadly rounded, but narrower than in *S. clypeata;* mandibles when closed ¼ to ⅕ the length of the remainder of the head, with the stout basal teeth hidden beneath the clypeus, the succeeding toothless space very short, the apical teeth comprising 5 pair of long, acute teeth decreasing somewhat in length anteriorly, and merging without a gap into the apical series of numerous smaller teeth; posterior border of head deeply excised; antennal scapes broadly curved on the basal third; first joint of the funiculus distinctly shorter than the fourth, the terminal joint slightly longer than the remainder of the funiculus. Thorax as in *S. clypeata;* the dorsum of the mesonotum somewhat flattened, not marginate laterally; mesoepinotal suture distinct but not constricted; epinotal spines acute, slightly divergent, directed backwards; infraspinal lamellæ narrow, uniform in width. Petiole, postpetiole and gaster as in *S. clypeata* and related species.

Head, thorax and petiole coarsely and densely reticulate-punctate, opaque; meso- and metapleura, dorsal surface of postpetiole and gaster smooth and shining; first gastric segment with numerous coarse longitudinal striae on the basal ⅓; sculpture of the clypeus much finer than the rest of the head, densely and finely crenulate-punctate, subopaque. Hairs on the clypeus numerous, erect, anteriorly curved, narrowly squamose at their tips, those on the sides ⅕ the width of the clypeus, those in the middle somewhat shorter; hairs on the rest of the head sparse, longer, thin, clavate, 1 or 2 on each side of the head very long and not clavate. Hairs on antennal scapes numerous, similar to those on the vertex of the head, curved toward the tip of the scapes;

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[3] Wesson, L. G., Jr., Contributions to the Biology of Strumigenys pergandei Em., Ent. News, vol. 47, pp. 171-174 (1936).

hairs on thorax irregular, long, thin, not clavate, the majority subappressed; gaster bearing 2 or 3 long hairs, usually near the base, a number of shorter hairs at the tip. Spongiform processes as in *S. clypeata* and related species.

Color dark ferruginous, the appendages slightly lighter, the gaster darker.

S. medialis possesses the general characteristics of *S. clypeata* and the species related to it. It may readily be separated from other forms, however, by (1) the longer mandibles, which are ¼ to ⅕ the length of the head; (2) the more narrowly rounded clypeus, the surface of which is subopaque; (3) the pilosity of the clypeus, the hairs of which are longer, erect, feebly squamose and sharply curved apically, and (4) generally by the pilosity of the rest of the head and antennal scapes.

Type locality: Beaver, Pike County, Ohio.

Described from a colony of about 30 workers and several dealate females taken from the hickory log described above under *S. deitrichi.* The nest consisted of irregular cavities in the outer rotten portion of the log which appeared to be old galleries of beetle larvae. The colony was transferred to an artificial nest where, as did other species of *Strumigenys* we have had under observation, they fed on living springtails. In their hunting they were quite inactive, even more so than *S. pulchella;* the workers would remain in a crouching position, head close to the substratum, mandibles closed, antennae partially folded, for a great deal of the time. Occasionally some of the dealate females were observed hunting like the workers. Otherwise the hunting methods of this species resembled those of *S. pergandei.*

Strumigenys (Cephaloxys) bimarginata, sp. n.

Worker: (Pl. 3, fig. 2) : Length, 1.7 mm.

Head, exclusive of mandibles, 3.3 times the greatest width of the clypeus, 5.7 times the length of the exposed portion of the closed mandibles. Viewed anteriorly, the sides of the head anterior to the antennal insertions are straight, converging, their projections lying along the exterior border of the closed mandibles; clypeus rather narrow but evenly rounded, not acute, flattened dorsally; clypeus viewed from the side with its edge broadly and deeply grooved along the entire lateral and anterior borders, thus giving the clypeus the appearance of having 2 margins, a thin but narrow upper margin and a thicker broader lower margin which projects beyond the upper margin and is visible when the clypeus is viewed anteriorly. Mandibles rather slender and elongate, the exterior border straight basally, feebly convex apically; basal tooth stout, partially concealed by the clypeus when the mandibles are closed; succeeding toothless space very short; apical teeth comprising 7 or 8 large irregular teeth which decrease in size anteriorly to merge into the apical series of numerous small teeth. Antennal scapes broadly curved basally, not angulate, fourth funicular joint slightly longer than the first; terminal joint slightly longer than the remainder of the funiculus. Sides of head posterior to the antennal insertions suddenly expanding to a broadly circular border so that that portion of the head appears subglobose when viewed anteriorly. Posterior border narrowly and rather deeply excised. Thorax essentially as in *S. clypeata;* mesoepinotal suture distinct but not constricted; median longitudinal carina prominent, especially on the basal surface of the epinotum. Petiole, postpetiole and gaster as in *S. clypeata.*

Head, thorax and petiole densely reticulate-punctate, subopaque; vertex of head with 8 or 10 broken irregular longitudinal rugae. Mandibles, clypeus, sides of mesonotum, meso- and metapleura, dorsum of the postpetiole and gaster smooth and shining; basal 1/4 of the first gastric segment with numerous coarse longitudinal striae.

Hairs on clypeus sparse, long, erect, more numerous on the edges, each hair being fairly straight at the base, curved and slightly enlarged on the apical 1/3, 1/4 to 1/2 the width of the clypeus; hairs on vertex numerous, shorter, erect, clavate, curved anteriorly; antennal scapes with numerous hairs similar to those on the vertex but less clavate, curved toward the tips of the scapes; hairs on the thorax, petiole and postpetiole numerous, variable, those on the thoracic dorsum being rather long, slightly clavate, appressed, those on the petiole and postpetiole averaging longer, more erect and not clavate; gaster with sparse, long, slender, erect hairs. Spongiform processes as in *S. clypeata* and related species.

Color ferruginous; mandibles, antennae and legs slightly lighter; gaster darker.

This very distinctive species is readily recognized by (1) the doubly margined character of the clypeal border; (2) the smooth and shining surface of the clypeus, and the more extensive shining areas on the thorax; (3) the shape of the head (4) the pilosity of the head.

Type locality: Cedar Mills, Adams County, Ohio.

Described from a single worker found under a piece of bark lying on the ground in a somewhat open, grassy spot in rather brushy cut-over woods. A deälated female belonging to this species was found about 15 cm. distant in some thin, vegetable debris. Further search failed to reveal any more specimens.

Strumigenys (Cephaloxys) manni, sp. n.[4]

Worker: (Pl. 3, fig. 3): Length, 1.8-2.0 mm.

Head 2.5 times as long as the greatest width of the clypeus, 1.3 times the greatest width across the occipital lobes; viewed anteriorly, the sides of the head anterior to the antennal insertions are gently convergent, slightly convex, in outline merging without definite change of slope with the exterior borders of the mandibles; clypeus with lateral borders gently convergent, nearly straight, the anterior border truncate at, or a little anterior to, the point of intersection of the lateral and external mandibular borders; in some specimens, the anterior border is slightly emarginate, in others it is somewhat angularly convex in the middle, but the truncate appearance is not lost. Occipital lobes expanding suddenly but not strongly from the anterior portion of the head, at first broadly convex, then more strongly convex as the posterior border is approached; posterior border rather broadly and moderately excised. Mandibles ¼ the length of the rest of the head, rather robust, the external border broadly and evenly convex; basal teeth very broad and short, partially concealed by the clypeus when the mandibles are closed, followed without an intervening toothless space by 5 pairs of moderately long acute teeth, the third pair somewhat longer than the others, these acute teeth followed by the apical series of several much smaller teeth. Eyes small, comprising 10 or 12 facets. Antennal scapes 3/5 the length of the funiculi, rounded but not angulate on the basal third; fourth joint of the funiculus very slightly shorter than the first, terminal joint as long as the remainder of the funiculus. Thorax as in *S. clypeata,* humeri and lateral margins smoothly rounded, somewhat flattened on the dorsum of the mesonotum, mesoepinotal suture distinct, slightly constricted; epinotal spines acute, thin; infraspinal lamellae narrow, not expanded ventrally. Node of petiole in profile rather prominent, broadly convex, the anterior slope rising suddenly but gently from the peduncle, the posterior slope declining very distinctly to the junction with the postpetiole.

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[4] It gives us pleasure to name this distinctive species after Dr. W. M. Mann, from whom we have received many kind favors.

Head, thorax and petiole reticulate-punctate, subopaque; mandibles, meso- and metapleura, dorsum of the postpetiole and gaster smooth and shining; first gastric segment with numerous, coarse, longitudinal striae on the basal 1/5.

Hairs on head and thoracic dorsum numerous, moderately long, thin, curved and somewhat clavate at their tips; those on the clypeus shorter, curved laterally and anteriorly, a few on the borders of the clypeus slightly longer, curved posteriorly; hairs on antennal scapes erect, clavate on the anterior edge, more numerous and thinner dorsally, deflected toward the tips of the scapes; hairs on the thorax more irregular in length and distribution, and less clavate; hairs on the petiole, postpetiole and gaster very long, thin, very few on the gaster.

Color, light to dark ferruginous; tarsi and antennal funiculi slightly paler; gaster darker.

Type locality: Pike County, near Sinking Spring, Ohio.

Described from 32 workers obtained by sifting dirt and humus in the small cedar grove described below under *S. missouriensis.* The spot was situated at the base of a hill where the soil above the underlying limestone was only 5 to 8 cm. deep. The ground was shaded by cedar and small oak trees and was covered with a rather thick, loose humus abounding with springtails.

In shape of the head, *S. manni* bears a superficial resemblance to *S. margaritæ* Forel, but differs from that form in characters too numerous to mention. It is distinguished generally by (1) the decidedly truncate appearance of the clypeus; (2) the long and robust mandibles; (3) the mandibular dentition; (4) the relative prominence of the node of the petiole; (5) the character of the pilosity of the head and thorax; (6) the shorter terminal joints of the antennae.

Strumigenys (Cephaloxys) rostrata Emery

Jackson, Pike, Ross and Scioto counties.

We have taken this species in both soil and wood, sometimes in decidedly dry situations. Three colonies were found respectively in the hickory log mentioned under *S. deitrichi*, the decaying portion of a large elm tree in which also lived a colony of *Aphaenogaster tennesseensis* Mayr, and in a crevice in a stump in a wooded pasture, a few centimeters from another colony of *A. tennesseensis*. 3 colonies were taken on the edge of some dry oak woods, all in or on the humus just under the dry oak leaves, which, with some grass and herbs, covered the ground. The nesting site of one was a rotten hickory nut; the second was in some cavities in a small decayed stick; the third was living in a crevice of a partly buried board. Workers were found under the leaves in the vicinity of the nests, presumably foraging. They were not apparently associated with any other ants. A few dead springtails were found in one of the nests. On one occasion a colony of *rostrata* was found living in a chamber in dry soil under a stone. Under the stone there also ran a few galleries of *Lasius umbratus mixtus* var. *aphidicola* (Walsh).

A *rostrata* colony was transferred to an artificial nest for observation. While employing the same general methods of hunting springtails as the other species studied, the *rostrata* workers differ in being more active. Instead of crouching in one spot awaiting the advent of a springtail, they spend most of their foraging time moving over the debris in the nest. When a worker scents a springtail 2 or 3 mm. away, she crouches, and, without touching it, tries various avenues of approach until she is so close that her mandibles almost touch the springtail. Then, head lowered, mandibles closed, antennae partially folded, she waits until the springtail, unaware of her presence, walks against her head. Then, seizing it with a quick snap of her mandibles, she quickly dispatches it with her sting. If, on the other hand, the springtail moves away from the ant, the latter repeats her approach. If the springtail shows no inclination to move within a few minutes, the ant often acts as though impatient, and tries to examine it with her antennae, or to take it in her mandibles.

Strumigenys (Cephaloxys) pulchella Emery

We have found this species on about 15 occasions, each time in dead wood. A typical habitat seems to be a log or stump or dead portion of a tree trunk, well-decayed for 3 or 4 cm. beneath the bark, moist but not wet, warm but not in full sun. Such desirable situations are almost always inhabited by species of *Aphænogaster, Lasius niger* var. *americanus* Emery, or *Camponotus herculeanus pennsylvanicus* var. *ferrugineus* (F.). Whether *S. pulchella* is definitely associated with the other species, as is *S. pergandei*, or whether it is simply a matter of such a situation being a very favorable one for other reasons, we have not determined. Although we have seldom taken *pulchella* workers in the frequented galleries of other ants, the colonies have seemed to be much more definitely associated with a larger species than chance alone would account for.

Several times when logs and stumps were broken open *pulchella* workers were seen carrying dead springtails in their mandibles, and when kept in an artificial nest they readily captured and killed these insects. They would, however, accept bits of dead flies after having been starved for a few days. Their hunting methods are similar to those of *S. pergandei*, but the workers are less active. They walk less around the galleries and amid the woody debris provided them and often crouch for hours at a cranny. When a springtail approaches, the worker merely lowers its head, turns in the direction of the quarry and waits. Only when the springtail touches the fore part of its head and mandibles does the *pulchella* snap and seize it. Once a dead springtail was gently pushed close to a waiting *pulchella* worker. The latter crept up to about the length of its head away, then crouched, holding its antennae partially folded.

After waiting in this position for a considerable time, it rose, extended its antennae and vibrated them rapidly, then crouched again. This was repeated two more times before the ant, as if impatient after ¾ of an hour, walked up to the springtail and seized it.

Winged phases were taken from nests in mid August.

Strumigenys (Cephaloxys) missouriensis M. R. Smith

Four colonies and numerous stray workers were found in a cedar thicket in western Pike County. The first workers were seen in and around some little-used gallaries of *Aphænogaster fulva aquia* var. *picea* Emery under a small stone, and the colony was located about 30 cm. away just beneath the humus. Two other colonies were likewise in the soil, not more than 4 cm. below the surface. The latter, however, were not visibly associated with any other ants. Scattered, stray workers were found just under the top layer of the humus. The cedar grove was located on the gently sloping base of a hill. Mingled with the cedars were a few small oaks and an occasional maple sapling. The soil was a black clay from 5 to 15 cm. deep above the limestone bed rock. Above the clay was a thick, springy layer of loose decaying cedar needles, leaves and grass. Abounding in this debris were *Ponera coarctata* subsp. *pennsylvanica* Emery, *Myrmecina graminicola* (Latr.) subsp. and hordes of Collembola, as well as *Strumigenys*. Here, in an area of 3 by 9 meters, were found *S. missouriensis* M. R. Smith, *S. manni* new species, *S. deitrichi* M. R. Smith, and *S. venatrix* new species.

On careful comparison of our specimens with 2 worker cotypes loaned by Dr. M. R. Smith, we find that, although some of the workers agree closely with the cotypes, there is quite a perceptible amount of variation both among workers from the same colony and among the 4 colonies found. This variation lies almost entirely in the direction of forms which differ from the cotypes in the following details: (1) the head is slightly more robust; (2) the clypeus is slightly depressed in the middle; (3) the antennal scapes are somewhat more angulate; (4) the sculpture is distinctly coarser; (5) the hairs on the head are larger, especially on the clypeus, and are fewer in number.

Strumigenys (Cephaloxys) reflexa, sp. n.

Worker: (Pl. 3, fig. 4): Length, 1.75-1.85 mm.

Head robust; exclusive of mandibles, 2 to 2.2 times as long as the greatest width of the clypeus, 1.3 times the greatest width across the occipital lobes; clypeus broadly rounded laterally, more narrowly rounded in the middle of the anterior border, the sides strongly scalloped; anterior portion of the head with a very broad distinct depression extending from the anterior portion of the clypeus to between the frontal carinae; occipital lobes broadly and rather evenly rounded; posterior border shallowly excised. Mandibles 1/6 the length of the rest of the head, moderately robust, the external borders gently convex; the pair of basal teeth stout, just hidden when the mandibles are closed, succeeded by a toothless space which is equal to 1/3 the length of the mandibles anterior to them, the toothless space followed by 4 or 5 pairs of rather short acute teeth which meet the apical series of numerous fine denticles. Antennal scapes rather sharply but not strongly angulate basally, 2/3 as long as the funiculi; fourth funicular joint decidedly shorter than the first, the terminal joint almost half again as long as the remainder of the funiculus.

Thorax as in *S. puchella;* mesoepinotal suture distinct, slightly constricted. Epinotal spines broad and thin; infraspinal lamellæ wide, broadly expanded ventrally.

Head, thorax and petiole reticulate-punctate, subopaque; head, especially on the dorsal posterior half coarsely tuberculate. Meso- and meta pleura, dorsum of the postpetiole and gaster, smooth and shining; first gastric segment with numerous coarse longitudinal striae on the basal 1/4.

Clypeus with a few, short, irregular squamose hairs on the border; projecting from the edge of the clypeus on each side are 3, occasionally 4, long coarse squamose hairs which are strongly curved posteriorly; the rest of the dorsal surface of the head with more numerous erect, curved, narrow squamose hairs, curved predominately posteriorly; antennal scapes with 6 or 8 erect, clavate hairs on the outer border, most of which are slightly curved toward the bases of the scapes. Hairs on thorax sparse, irregular in length, erect, slightly enlarged apically. Petiole, postpetiole and gaster with long thin erect hairs, slightly enlarged apically. Legs and antennal funiculi with thin reclinate hairs. Spongiform processes as in *S. pulchella*.

Color ferrugineus; the gaster, darker.

Type locality: Jackson, Ohio.

We have compared *S. reflexa* with cotypes of *S. missouriensis* M. R. Smith and *S. sculpturata* M. R. Smith to both of which it is very similar. From *S. missouriensis* it may be distinguished by (1) the broad depression on the anterior portion of the head; (2) the much more strongly scalloped and sculptured head; (3) the less convex mandibles; (4) character of the pilosity. From *S. sculpturata* it differs in (1) the more robust head; (2) the rounded, non-truncate clypeus; (3) the slightly less abundant pilosity, particularly on the clypeus and gaster; (4) the appearance of the 6 large fringing clypeal hairs which are curved strongly backward —a feature by which this form may be easily recognized.

A colony of this species was found in a small, punky, partly-buried board in moderate shade in a backyard in Jackson. The colony was within a meter of a large log pile, and workers were found foraging among the woody debris at the base. Stray workers were discovered at 2 other places in the yard. An early attempt to find the above colony gives a check on the feeding habits of the species. A dead springtail was placed in front of a worker which had been discovered beneath a piece of bark. Apparently not greatly disturbed, the ant continued to stalk among the debris until she came within about 1 mm. of the springtail. She then crouched and waited. After several minutes, the springtail was gently pushed toward the ant until it was partly on top of her head. The next instant the ant was to be seen holding the already dead springtail tightly in her mandibles and stinging it viciously. In a few seconds she started off at a rapid pace with the springtail. In the artificial nest the hunting methods of the workers were similar to those of *S. pulchella*, but even more sluggish.

Strumigenys (Cephaloxys) venatrix, sp. n.

Worker: (Pl. 3, fig. 5) : Length, 1.8-2.0 mm.

Head relatively slender, exclusive of the mandibles, 2.7 times the width of the clypeus, 1.4 times the greatest width across the occipital lobes; anterior portion of the head as viewed from the front slightly but perceptibly converging; clypeus with sides converging gently on the basal ⅔, the anterior border very broadly rounded, somewhat flattened in appearance, but definitely not truncate; the dorsal surface evenly convex, the edges with very small, inconspicuous scalloping; the occipital lobes very broadly convex anteriorly, more strongly convex as the posterior border is approached; posterior border broadly and rather deeply excised. Mandibles somewhat less than ⅕ the length of the head alone, rather slender, the external borders gently convex; basal teeth stout, partially concealed by the clypeus when the mandibles are closed, followed by a toothless space ⅓ the length of the mandibles anterior to the basal teeth, the toothless space terminated by 4 or 5 pair of acute teeth somewhat irregular in length, but longer basally, which meet the apical series of smaller irregular denticles. Antennal scapes moderately curved, not angulate basally, about ⅗ the length of the funiculi; fourth funicular joint slightly longer than the first, terminal joint slightly longer than the remainder of the funiculus. Thorax similar to that of *S. pulchella;* with a distinct and somewhat constricted meso-epinotal suture. Epinotal spines moderately broad and thin; infraspinal lamellae moderately broad, not or very slightly expanded ventrally. Petiole in lateral profile with node rather low but broad, the anterior slope rather short.

Head, thorax and petiole reticulate-punctate, subopaque, the reticulations, especially on the mesonotum, tending to form faint longitudinal rugae. Meso- and metapleura, dorsum of the postpetiole and gaster smooth and shining. First gastric segment with numerous coarse longitudinal striae on the basal ⅓.

Hairs on the clypeus short, subappressed, moderately squamose; the sides of the clypeus bearing a fringe of 10 or 12 anteriorly curved hairs on each side, the hairs occurring as pairs, one hair in each pair long, very narrowly squamose, the others, arising medially to the first, shorter and more squamose; hairs on antennal scapes comprising 5 or 6 moderately long, narrowly squamose hairs on the external border curved toward the tips of the scapes, and in addition numerous thin, straighter, subappressed hairs. Thorax with sparse, moderately long, thin, reclinate hairs. Petiole, postpetiole and gaster with sparse, long, thin, curved, erect hairs. Legs with thin, moderately long, reclinate hairs. Spongiform processes approximately as in *S. pulchella.*

Color ferrugineus; gaster darker.

Type locality: Kitts Hill, southern Lawrence County, Ohio.

Similar to *S. pulchella* Emery and *S. creightoni* M. R. Smith. From *S. pulchella, S. venatrix* differs in (1) the narrower anterior portion of the head, and correspondingly a proportionately wider posterior portion; (2) the differently shaped clypeus; (3) the longer mandibles; (4) the different pilosity, particularly on the head. From *S. creightoni,* which it closely resembles in the shape of the head and mandibles, *S. venatrix* differs in (1) its entire and rounded clypeal borders; (2) the very different pilosity, especially on the vertex of the head and on the thorax.

Described from a colony containing about 60 workers.

Eight colonies and occasional scattered workers have been taken in Pike, Lawrence, Scioto and Adams Counties. The species is definitely a soil or humus dweller and forages for Collembola under the leaves and dead vegetable matter on the surface of the ground. So far as we can tell, it is not associated with other species for the purpose of obtaining the Collembola about their nest. Specific examples of the colonies may give a better idea of the habitus. A colony was found in a small opening near the edge of some young oak woods on a rather dry, gently-sloping hillside. The soil was a sandy clay. Several workers were first observed around a light cover of dead leaves. One of these, carrying a springtail in its mandibles, led to the nest, the entrance of which, was a tiny hole under a flake of stone in the middle of a small bare area 30 sq. cm. in extent. Just below the surface, this hole widened out into a spacious, elongate chamber 5 to 10 mm. in diameter and 10 cm. in length, which appeared to be the hollow interior of a dead and decayed root. Another colony was found in the grassy humus on the edge of a bushy thicket in a field. A colony of *Aphaenogaster fulva* was under an adjacent stone. Four colonies, including the type, were found in a grassy clearing in some dry, open woods. Two of these colonies were on the surface in the tangled roots of the grass, while the other 2 were in the soil 2 to 8 cm. below the surface. Galleries of *Camponotus castaneus* subsp. *americanus* Mayr ran close to one nest, but we were unable to find any connection between the two. Two colonies were found in the cedar thicket described above under *S. missouriensis*. One of these was nesting in an opening at the bottom of the humus, the other in a small cavity at the base of an old rotted cedar stump. Stray workers in these and other places were often found by pulling back the top cover of the humus in places where springtails were abundant.

Strumigenys (Cephaloxys) abdita, sp. n.

Worker: (Pl. 3, fig. 6) : Length, 2 mm.

Head, exclusive of mandibles, 1.3 times as long as the greatest width across the occipital lobes, 2.4 times as long as the greatest width of the clypeus; sides of anterior portion of head very slightly convergent; clypeus short and broad, the anterior border strongly flattened or truncate but not so as to make the head appear sharply rectangular; mandibles rather long and slender, compressed dorso-ventrally, ¼ - ⅕ the length of the head alone, the internal border nearly straight, the external border straight on the basal half, gently convex on the apical half; mandibles with a pair of large basal teeth partially concealed by the clyeus when the mandibles are closed; basal teeth followed by a toothless space ⅓ the length of the portion of the mandibles anterior to them; terminal teeth comprising a compact row of 4 or 5 pair of large acute teeth, the second largest, the rest decreasing somewhat in length anteriorly, meeting and merging with little interruption into the apical series of a number of small teeth on the deflected tip of the mandibles; antennal scapes slightly angulate basally; first joint as long as the fourth; terminal joint 1¼ times as long as the rest of the funiculus. Humeri prominent, broadly angulate; median dorsal carina of thorax obsolescent; prominent lateral carinae present on base of epinotum terminating in the epinotal spines; epinotal spines somewhat longer than broad at the base, acute, flattened; infraspinal lamellae moderately wide dorsally, each suddenly expanding ventrally into a wide, rounded plate; mesoepinotal suture distinct, slightly constricted. Node of petiole in profile rather strongly convex above.

Head, thorax and petiole reticulate-punctate, subopaque, the sculpture on the clypeus decidedly finer than on the rest of the head; frontal area, sides of the mesonotum, meso- and metapleura, dorsum of the postpetiole and gaster smooth and shining, first gastric segment with numerous coarse longitudinal striae on the basal ⅓.

Hairs on the clypeus numerous, moderately long, somewhat irregular, erect, the tips spatulate and curved horizontally, numbering about 30 on the dorsal surface, the border with 10 or 12 similar hairs curved anteriorly, the whole effect giving the clypeus a woolly appearance when viewed under low magnification. Pilosity of the rest of the head sparser, more curved and narrowly squamose; across the posterior border of the head is a transverse row of 4 evenly spaced, very long, thin, erect hairs; although 1 or 2 of these is sometimes missing, the position of the others is not altered. Antennal scapes with 5 or 6 irregular, moderately long, erect, narrow, squamose hairs on the external border, 4 or 5 similar but much shorter hairs on the dorsal surfaces. Thorax with sparse, moderately long, clavate, subappressed hairs and 1 or 2 much longer erect, thin hairs confined principally to the dorsum of the mesonotum. Node of petiole with numerous rather short, curved, blunt or clavate hairs. Postpetiole and gaster with very few long, slender, nearly straight hairs.

Color ferruginous; gaster darker.

Type locality: Jackson, Ohio.

Described from 3 workers found under a board and pieces of slate in a shaded spot in a backyard in Jackson. We did not succeed in locating the colony. It may be noted that of the 4 species of *Strumigenys* (*pergandei, rostrata, reflexa, abdita*) found in this yard, 2 were undescribed.

In order to facilitate the separation of the 6 new forms described above, we have modified Smith's key[5] to include them, as well as several other species described[6] since the publication of Smith's paper.

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[5] Smith, M. R., 1931, Revision of the Genus Strumigenys of America North of Mexico, Based on a Study of the Workers, Ann. Ent. Soc. Amer., 24, pp. 686-710.

Key to Workers of Strumigenys, subgenus Cephaloxys of the United States.

1. Dorsal surface of first gastric segment clearly shagreened, subopaque; infraspinal lamella absent .... *margaritæ* Forel.

Dorsal surface of first gastric segment smooth and shining; infraspinal lamella present 2

2. Prothorax not only flattened, but also very strongly marginate laterally; head almost destitute of pilosity except for a pair of short, more or less erect, club-like hairs on the vertex... *membranifera simillima* Emery

Prothorax not as above; head covered more or less abundantly with varied types of pilosity 3

3. Sides of head as viewed from the front evenly and smoothly converging to the apices of the mandibles. 4

Sides of head subparallel or only slightly converging; external border of mandibles not lying on an anterior projection of the sides of the head 15

4. Clypeus very acute anteriorly; clypeal hairs few, long, erect, thickened, confined principally to the median anterior portion of the disk .... *deitrichi* M. R. Smith

Clypeus distinctly not as above 5

5. Clypeus smooth and shining 6

Clypeus opaque or subopaque 8

6. Clypeal hairs short, curved, apically enlarged .... *brevisetosa* M. R. Smith

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[6] Kennedy, C. H., and Schramm, M. M., 1933. A New Strumigenys with Notes on the Ohio Species, Ann. Ent. Soc. Amer., 25, pp. 95-104. (*S. ohioensis*)

Weber, N. A., 1934, A New Strumigenys from Illinois, Psyche, 41, pp. 63-65. (*S. talpa*)

Smith, M. R., 1935, Two New Species of North American Strumigenys, Ann. Ent. Soc. Amer. 28 pp. 214-216. (*S. rohweri, S. brevisetosa*)

Clypeal hairs long, ½ to ⅓ times the width of the clypeus 7

7. Edge of clypeus in profile entire; clypeal hairs straight, thin, abundant; hairs on vertex sparse, hardly clavate .... *clypeata* var. *laevinasis* M. R. Smith

Edge of clypeus in profile deeply grooved; clypeal hairs sparse, curved, slightly enlarged apically; hairs on vertex numerous, shorter, clavate (Pl. 3, fig. 2) .... *bimarginata* sp. n.

8. Clypeus with a few, long hairs, very much enlarged apically and principally on the anterior portion of the disk and also a pair of long, thick, recurved, but not suddenly enlarged hairs, posteriorly *ornata* Mayr

Clypeal pilosity distinctly not as above 9

9. Clypeal hairs straight, imperceptibly or not at all enlarged 10

Clypeal hairs curved, distinctly clavate or squamose 11

10. Clypeal hairs short, not over ⅛ as long as the width of the clypeus .... *ohioensis* Kennedy and Schramm

Clypeal hairs long, ⅓ to ½ the width of the clypeus.... .... *pilinasis* Forel

11. Clypeal hairs short, squamose, appressed 12

Clypeal hairs longer, more or less erect, clavate or narrowly squamose 13

12. Clypeus broadly and evenly rounded; the surface in large part concealed by the squamose hairs .... *clypeata* Roger

Clypeus very broadly rounded, appearing somewhat truncate; clypeal surface almost entirely concealed by the spatulate hairs .... *rohweri* M. R. Smith

13. Clypeus rather sharply truncate in appearance; mandibles ¼ the length of the rest of head (Pl. 3, fig. 3) .... *manni* sp. n.

Clypeus broadly rounded, not truncate; mandibles shorter 14

14. Head broader; mandibles less than ⅕ the length of the rest of the head; posterior border of head shallowly excised; toothless space of mandibles distinct .... *talpa* Weber

Head narrower; mandibles slightly more than ⅕ the length of the rest of the head; posterior border deeply excised; toothless space of mandibles small and indistinct. (Pl. 3, fig. 1.) .... *medialis* sp.n.

15. Mandibles longer, ⅓ the length of the rest of head, clypeus truncate or emarginate or very broadly flattened anteriorly 16

Mandibles shorter; clypeus variable 17

16. Clypeus decidedly truncate anteriorly, thus giving the head a subrectangular appearance; antennal scapes not only short but very strongly angulate basally .... *angulata* M. R. Smith

Clypeus, although moderately truncate anteriorly, not enough to give a decidedly subrectangular appearance to the head; scapes longer and less angulate basally .... *pergandei* Emery

17. Clypeus truncate or subtruncate in front 18

Clypeus broadly rounded in front 21

18. Mandibles with large coarse teeth on their entire inner borders; clypeus broadly truncate or slightly emarginate .... *rostrata* Emery

Mandibles toothed on only a part of their inner border; clypeus truncate but never emarginate 19

19. Mandibles longer, ¼ to ⅕ the length of the rest of head; clypeus very short and broad, the sides gently convergent (Pl. 3, fig. 6) .... *abdita* sp.n.

Mandibles shorter, ⅙ the length of the rest of head; clypeus longer, the sides more strongly convergent 20

20. Hairs on head rather abundant, distinctly squamiform .... *creightoni* M. R. Smith

Hairs on head less abundant, longer, and, although slightly enlarged apically, not squamiform .... *sculpturata* M. R. Smith

21. Sides of anterior portion of head gently and evenly convergent to the very broadly rounded clypeus; mandibles nearly ⅕ the length of the rest of head Pl. 3, fig. 5) ....*venatrix* sp.n.

Sides of anterior portion of head parallel, the clypeus evenly and broadly arid broadly rounded on its entire border; mandibles shorter 22

22. Clypeus decidedly depressed in the middle, the sides strongly scalloped, each side with 3 large, erect, squamose hairs which are curved posteriorly; head robust; mandibles somewhat convex (Pl. 3, fig. 4) .... *reflexa* sp.n.

Clypeus not as above 23

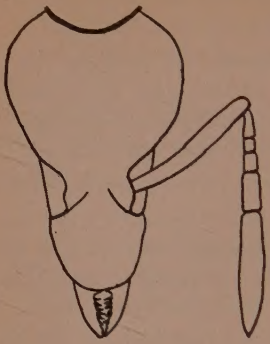
23. Head relatively robust in proportion to its length; upper half rugulose or tuberculate; mandibles robust, convex .... *missouriensis* M. R. Smith

Head relatively slender in proportion to its length; surface, although reticulate-punctate, not tuberculate; mandibles slender and somewhat laterally compressed .... *pulchella* Emery

LEGEND FOR PLATE III.

Fig. 1. *Strumigenys medialis* sp. n., head of worker.
Fig. 2. *Strumigenys bimarginata* sp. n., head of worker.
Fig. 3. *Strumigenys manni* sp. n., head of worker.
Fig. 4. *Strumigenys reflexa* sp. n., head of worker.
Fig. 5. *Strumigenys venatrix* sp. n., head of worker.
Fig. 6. *Strumigenys abdita* sp. n., head of worker.

PSYCHE VOL. XLVI PLATE 3



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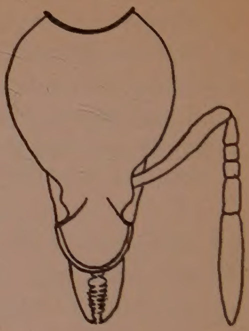

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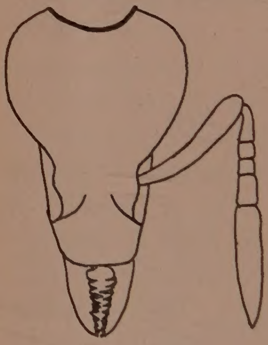

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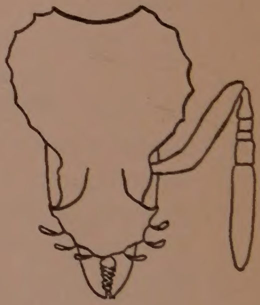

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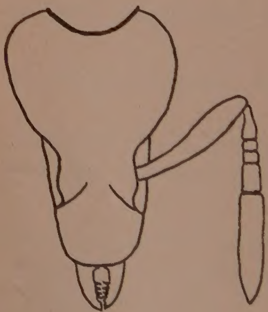

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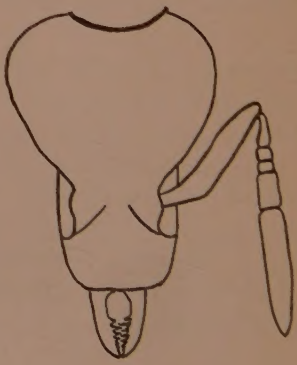

6

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